B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Habitat Evaluation Procedures (HEP) Report

Rainwater Wildlife Area

Technical Report 1998 - 2001 | January 2004 | DOE/BP-00000253-1

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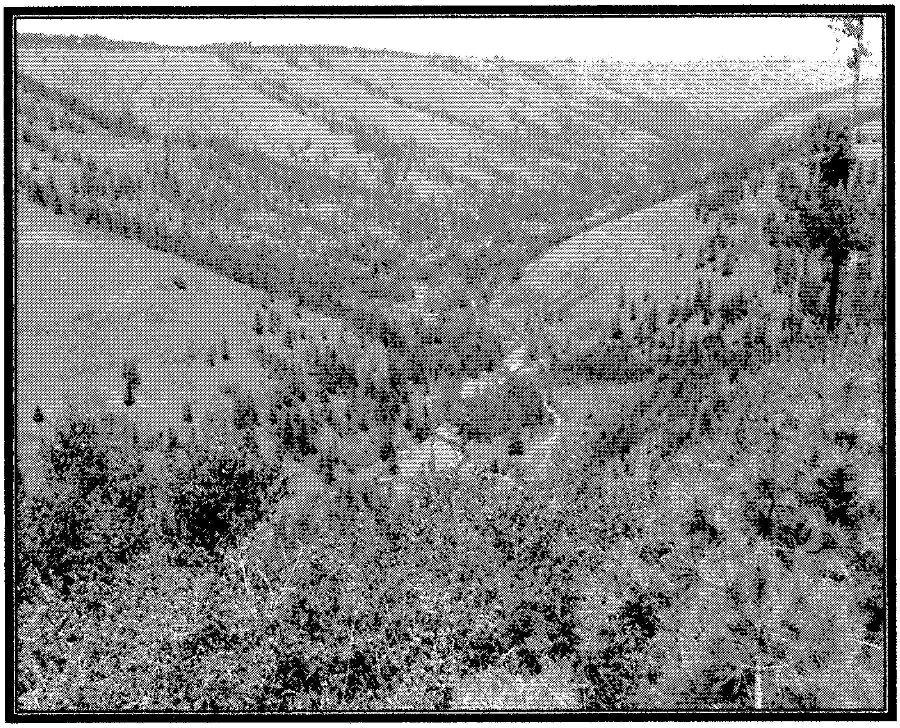
RAINWATER WILDLIFE AREA
Habitat Evaluation Procedures Report

A Columbia Basin Wildlife Mitigation Project

January 2004



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CONFEDERATED TRIBES UMATILLA INDIAN RESERVATION

BONNEVILLE POWER ADMINISTRATION

Abstract

The 8,768 acre Rainwater Wildlife Area was acquired in September 1998 by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) through an agreement with Bonneville Power Administration (BPA) to partially offset habitat losses associated with construction of the John Day and McNary hydroelectric facilities on the mainstem Columbia River. U.S. Fish and Wildlife Service (USFWS) Habitat Evaluation Procedures (HEP) were used to determine the number of habitat units credited to BPA for acquired lands. Upland and riparian forest, upland and riparian shrub, and grassland cover types are evaluated in this study. Targeted wildlife species include downy woodpecker (Picoides pubescens), black-capped chickadee (Parus atricopillus), blue grouse (Dendragapus obscurus), great blue heron (Ardea herodias), yellow warbler (Dendroica petechia), mink (Mustela vison), and Western meadowlark (Sturnella neglecta). Habitat surveys were conducted in 1998 and 1999 in accordance with published HEP protocols and included 65,300, 594m² plots, and 112 one-tenth-acre plots. Between 153.3 and 7,187.46 acres were evaluated for each target wildlife mitigation species. Derived habitat suitability indices were multiplied by corresponding cover-type acreages to determine the number of habitat units for each species. The total baseline habitat units credited to BPA for the Rainwater Wildlife Area and its seven target species is 5,185.3 habitat units. Factors limiting habitat suitability are related to the direct, indirect, and cumulative effects of past livestock grazing, road construction, and timber harvest which have simplified the structure, composition, and diversity of native plant communities. Alternatives for protecting and improving habitat suitability include exclusion of livestock grazing, road de-commissioning/obliteration, reforestation and thinning, control of competing and unwanted vegetation (including noxious weeds), reestablishing displaced or reduced native vegetation species, allowance of normative processes such as fire occurrence, and facilitating development of natural stable stream channels and associated floodplains. Implementation of habitat enhancement and restoration activities could generate an additional 1,850 habitat units in 10 years. Baseline and estimated future habitat units total 7,035.3 for the Rainwater Wildlife Area. Habitat protection, enhancement and restoration will require long-term commitments from managers to increase probabilities of success and meet the goals and objectives of the Northwest Power Planning Council's Fish and Wildlife Mitigation Program.

Baseline and Futures Analysis Summary

Evaluation Species	Evaluation Acres	Time to DFC (Years)	Existing Habitat Units	Habitat Units At Year=10
Downy Woodpecker	7,187.46	40	1,100.3	1,723.7
Black-Capped Chickadee	7,187.46	40	3,163.5	4,168.7
Blue Grouse	284.9	40	136.8	143.9
Great Blue Heron	596	40	119.2	119.2
Yellow Warbler	153.3	10	27.6	113.8
Mink	596	10	447	536.4
Western Meadowlark	1,423.06	100	191.9	229.6
Total			5,185.3	**7035.3**

Longer-term benefits of protection and enhancement activities include increases in native species diversity and plant community resiliency in all cover types. Watershed conditions, including floodplain/riparian, and instream habitat quality should improve as well providing multiple benefits for terrestrial and aquatic resources. While such benefits are not necessarily recognized by HEP models and reflected in the number of habitat units generated, they are consistent with the NPPC Fish and Wildlife Program. Development and implementation habitat enhancement and restoration strategies, coupled with protection

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INTRODUCTION

The Need for Fish and Wildlife Mitigation

The development of dams for hydropower, navigation, flood control, and irrigation in the Columbia River Basin resulted in widespread inundation of riparian, riverine, and upland wildlife habitats (NPPC 1994; BPA et. al., 1993). The 1980 Power Act established and charged the Northwest Power Planning Council with the task of developing a comprehensive fish and wildlife mitigation program to protect, mitigate, and enhance fish and wildlife habitat in the Columbia Basin (Power Act 1980, Section 4 (H)(1)(A), page 12; NPPC 1994, Section 2, page 2-1). This program, initially adopted in 1982, was amended in 1984, 1987, 1991-1993, 1994, and 2000.

Consistent with Section 1003(7) of the Power Council Fish and Wildlife Program, BPA is authorized and obligated to fund implementation of projects that will help reach the Power Council wildlife mitigation goals and objectives. The 1997 Final Environmental Impact Statement for the Wildlife Mitigation Program (Bonneville Power Administration, 1997), states:

> *"Bonneville Power Administration (BPA) is responsible for mitigating wildlife habitat loss caused by the development of the Federal Columbia River Power System. BPA meets this responsibility by funding projects submitted to and recommended by the Northwest Power Planning Council. "*

Wildlife Loss Assessments

The *Wildlife Impact Assessments for the John Day and McNary Projects* (Rassmussen and Wright, 1990b and d), provide estimated losses of 36,555 and 23,545 Habitat Units resulting from the John Day and McNary Hydroelectric facilities, respectively. Habitat losses included mainland, island, and river habitats. Mainland habitats, totaling an estimated 20,858 acres for the John Day facility and 12,898 acres for the McNary facility, consisted of shrub/steppe grassland, riparian hardwood, riparian shrub, riparian herb, emergent wetland, sand dune, sand/gravel/cobble/mud, disturbed/bare/riprap, and open water cover types. Approximately 6,708 acres of island habitats associated with the John Day facility and 2,741 acres associated with the McNary facility were impacted.

Northwest Power Planning Council Goals and Objectives

In its 2000, the Northwest Power Planning Council (NPPC or Council) adopted the following vision for its Fish and Wildlife Mitigation Program:

> *"The vision for this program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing the benefits from fish and wildlife valued by the people of the region. This ecosystem provides abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest and the conditions that allow for the recovery of the fish and wildlife affected by the operation of the hydrosystem and listed under the Endangered Species Act. Wherever feasible, this program will be accomplished by protecting and restoring the natural ecological functions, habitats, and biological diversity of the Columbia River Basin. In those places where this is not feasible, other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irrevocably changed the ecosystem, the program will protect and enhance the habitat and species assemblages compatible with the altered ecosystem. Actions taken under this program must be cost-effective and consistent with an adequate, efficient, economical and reliable electrical power supply.*
>
> *This is a habitat-based program, rebuilding healthy, naturally producing fish and wildlife populations by protecting and restoring habitats and the biological systems within them, including anadromous fish migration corridors."*

The NPPC also established four biological objectives for the Fish and Wildlife Program. They are:

1. A Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.
2. Mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem.
3. Sufficient populations of fish and wildlife for abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest.
4. Recovery of the fish and wildlife affected by the development and operation of the hydrosystem that are listed under the Endangered Species Act

The objectives of the NPPC Fish and Wildlife Program in regard to mitigating the loss of wildlife habitat associated with Federal hydroelectric power development in the Columbia River Basin include:

1. Quantify wildlife losses caused by the construction, inundation, and operation of the hydropower projects.
2. Develop and implement habitat acquisition and enhancement projects to fully mitigate for identified losses.
3. Coordinate mitigation activities throughout the basin and with fish mitigation and restoration efforts, specifically by coordinating habitat restoration and acquisition with aquatic habitats to promote connectivity of terrestrial and aquatic areas.
4. Maintain existing and created habitat values.
5. Monitor and evaluate habitat and species responses to mitigation actions.

The Rainwater Wildlife Mitigation Project

The 8,700 acre Rainwater Wildlife Area (Toosha') was established in September 1998 through land acquisition under the NPPC Fish and Wildlife Program, Interim Washington Wildlife Mitigation Agreement (DEMS79-93BP94146, April, 1993) and Memorandum Of Agreement (MOA), October 1997 between the CTUIR and BPA. The wildlife area was developed by the CTUIR to offset habitat losses related to the John Day and McNary hydroelectric projects. The project area is located outside the Columbia River corridor, and therefore provides off-site mitigation. However individual habitat types and species impacted by hydroelectric development will be addressed by this project, thereby providing in-kind mitigation. The Rainwater Wildlife Area is located in the Walla Walla Subbasin and upper South Fork Touchet River Watershed.

Cover Types and Target Wildlife Species

In-kind habitats and cover types provided by the project include riparian shrub and hardwood, sand/gravel/cobble/mud, and grasslands. Out-of kind cover types include coniferous forest. Primary HEP species selected to represent these habitats include the downy woodpecker (*Picoides pubescens*), yellow warbler (*Dendroica petechia*), great blue heron (*Ardea herodias*), mink (*Mustela vison*), Western meadowlark (*Sturnella neglecta),* black-capped chickadee (*Parus atricopillus*), and blue grouse (*Dendragapus obscurus*).

Crediting Habitat Units to BPA

The 1997 Memorandum of Agreement between BPA and the CTUIR provides the framework for how BPA receives mitigation credit for acquired lands. Through the MOA, BPA will received full credit for land acquisition, protection, and enhancement. The MOA included an estimated, combined minimum of 12,075 habitat units for the Rainwater Wildlife Area, Squaw Creek (Iskuulpa) Watershed Project, and Wanaket Wildlife Area. The minimum credit estimate was derived from a preliminary HEP analysis conducted for the Rainwater Wildlife Area and Iskuupla Watershed Project and a completed HEP for Wanaket. The preliminary analysis consisted of developing basemaps, delineating cover types and acreages, and providing estimates on habitat suitability based on limited field review and professional judgment. This report provides the detailed habitat evaluation for the Rainwater Wildlife Area and the basis for updating the BPA-CTUIR MOA.

Anadromous Fish Benefits

This report summarizes HU's for targeted wildlife mitigation species. However, the Rainwater Wildlife Area provides dual benefits for both wildlife and aquatic resources with over ten miles of spawning and rearing habitat for Walla Walla Subbasin Threatened summer steelhead, bull trout, and resident rainbow trout. The project is consistent with the Council's stated objective of "coordinating habitat restoration and acquisition with aquatic habitats to promote connectivity of terrestrial and aquatic areas."

Report Organization

The remaining sections of this report are organized as follows: 1) Physical Environment, 2) Biological Environment, 3) Methods; 4) Results, and 5) Consistency with NPPC Program.

PHYSICAL ENVIRONMENT

Wildlife Area Location and Description

The wildlife area is located in the North Blue Mountain Physiographic Province within the Walla Walla River Subbasin/South Fork Touchet River Watershed, about 8 miles south of Dayton, Washington in Columbia County within the aboriginal homeland of the CTUIR.

The project legal description is Township 7 North, Range 39 East, all or portions of Sections 4, 5, 6, 7, 8, and 9; Township 8 North, Range 39 East, all or portions of Sections 5, 8, 9, 17, 19, 20, 21, 27, 28, 29, 31, 32, 33, and 34, Willamette Meridian. (See Figures 1 and 2).

Dominant landscape features of the wildlife area include relatively flat ridgetops with interior forest habitat on Robinette Mountain and steep canyon lands bisected by a mosaic of grass/shrub plant communities and stringer timber draws with a wide, gentle riparian floodplain associated with the South Fork Touchet River.

The wildlife area is situated on the southern extent of Robinette Mountain, which is bounded by the South Fork Touchet River drainage to the west and the Robinson Fork to the east. Steep, short streams drain from the ridges into the South Fork Touchet River and Robinson Fork, leaving high tablelands between the two canyons. South of Robinette Mountain, the topography steepens, loses its north-south trend and is dominated by west flowing streams including Griffin Fork and the Burnt Fork.

Average topographic relief in the northern half of the property is 800 feet above sea level with a maximum of about 1,100 feet, while average topographic relief in the southern half of the property is 1,200 feet with a maximum elevation of about 4,860 feet. Minimum elevation is 2,240 and is located where the South Fork Touchet River crosses the northern boundary of the project area. The Burnt Fork marks the southern boundary of the property. Both streams drain into the South Fork Touchet River that flows northward along the western side of the property.

Aspect and elevation combine to provide similar or compensating environmental factors (temperature and moisture) that contribute to site productivity and the suitability of a site for a given plant community. As a combination of these factors is repeated across the landscape, a predictable plant community will occupy those sites given time and varying frequencies of disturbance (Johnson and Clausnitzer 1992). Tables 1 and 2 illustrate percent of project area by slope class and aspect class, respectively.

Figure 1 – CTUIR Ceded Territory Map

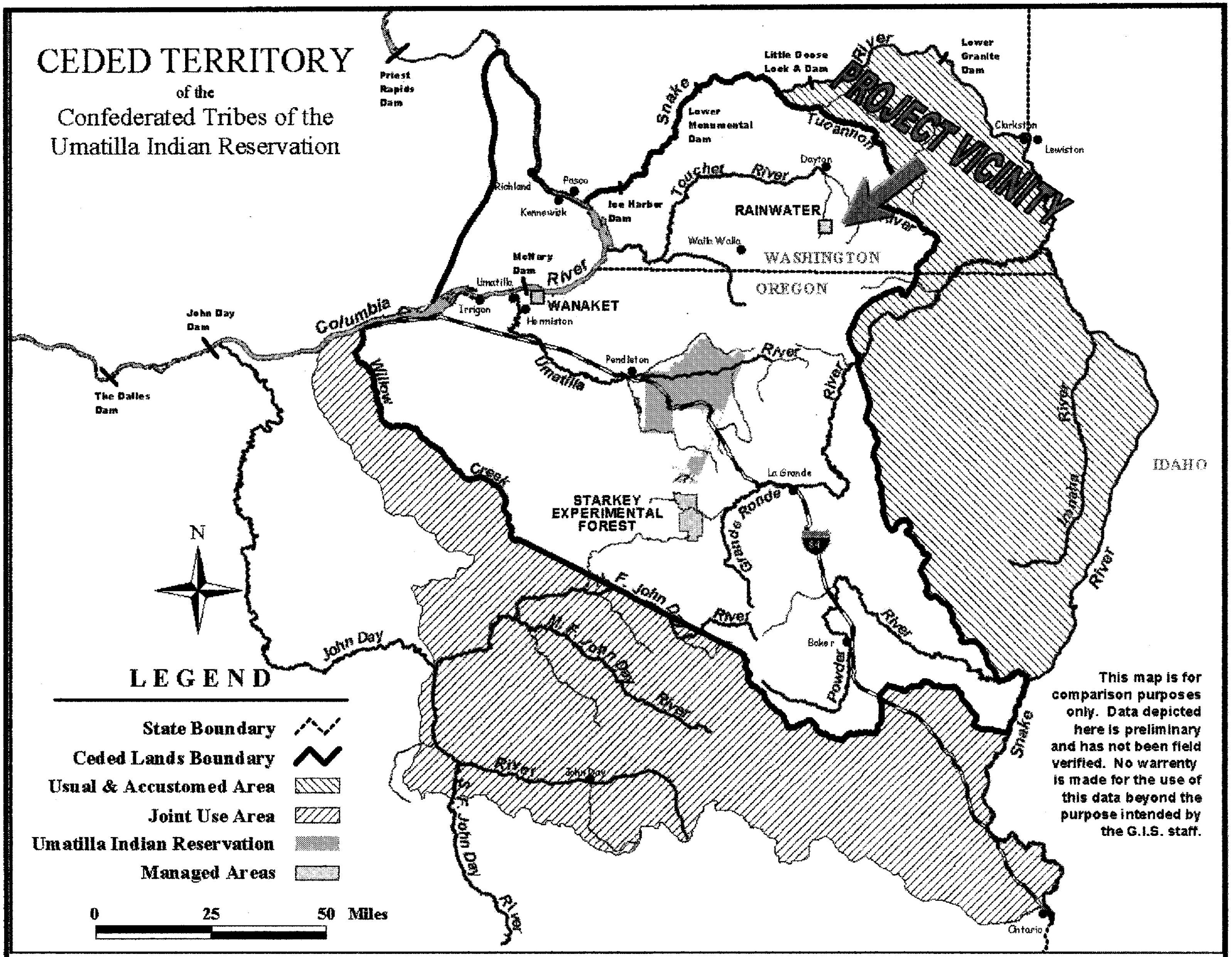


Figure 2 – Project Vicinity Map

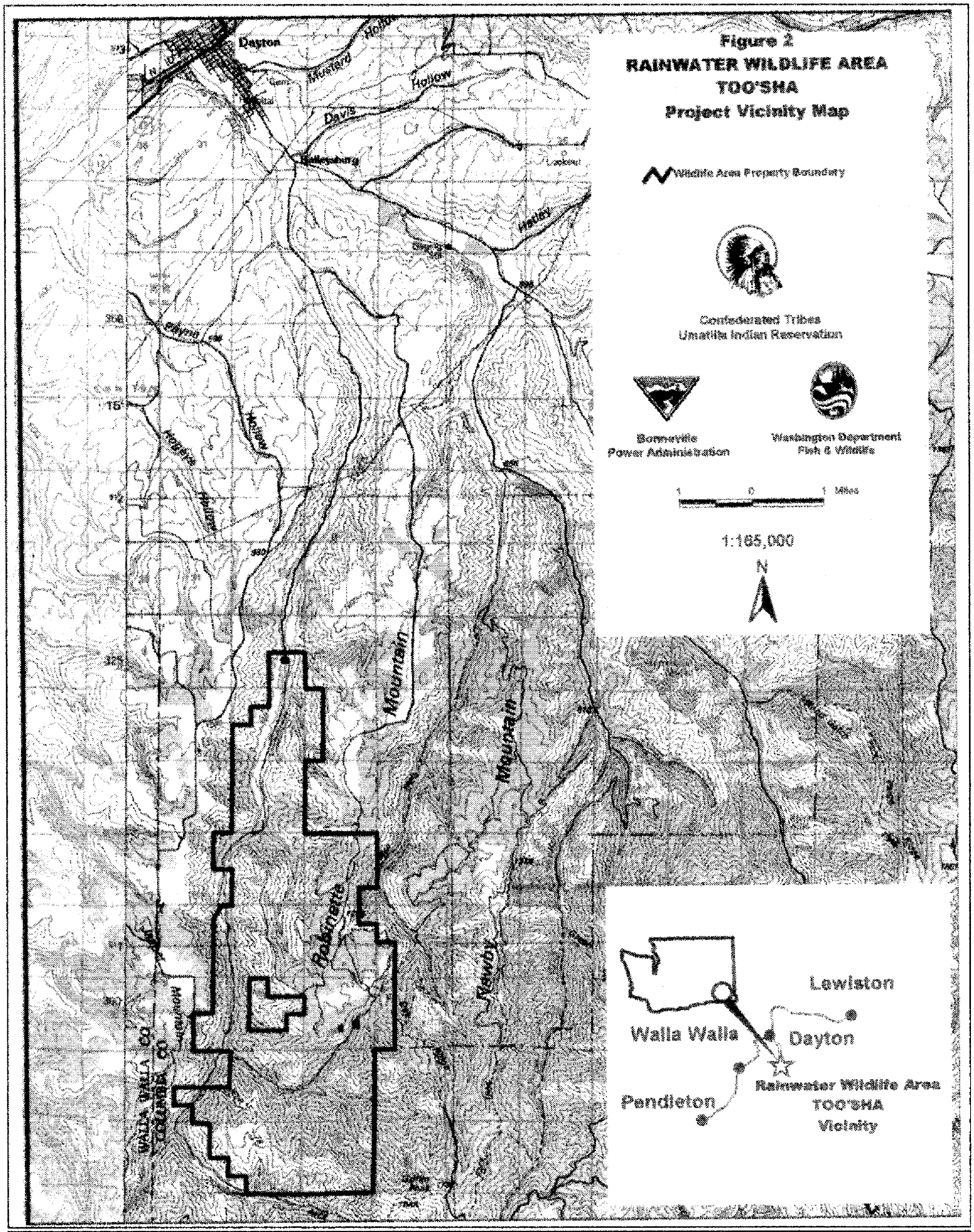


Table 1. Wildlife Area Slope Classes

Slope Class (%)	Percent of Watershed
< 5	9.5
5 < X < 25	16.7
> 25	73.8

Table 2. Wildlife Area Aspect Classes

Aspect Class	Aspect Degrees	Percent of Watershed
North	337.6 – 22.5	10.2
Northeast	22.6 – 67.5	9.3
East	67.6 – 112.5	9.1
Southeast	112.6 – 157.5	7.5
South	157.6 – 202.5	9.8
Southwest	202.6 – 247.5	10.8
West	247.6 – 292.5	16.9
Northwest	292.6 – 337.5	11.3
Flat	0	15.2

Climate

Climate of the wildlife area is typical of mid elevation Blue Mountain regions. The majority of annual precipitation in the South Fork Touchet River subwatershed accumulates as snow from October through late May, with intense thunder and lightning storms occurring in the late summer and early fall. Annual precipitation ranges from 25 to 40 inches.

The major influence on the regional climate is the Cascade Mountains, which form a barrier to warm, moist storm fronts originating on the Pacific Ocean. Ambient temperatures exhibit seasonal variation with maximum average temperatures during summer exceeding 80^0F and minimum temperatures falling below 20^0F during winter months (U.S. Army Corps of Engineers, 1997).

Watershed Hydrology

The wildlife area contains approximately 10 miles of fish bearing streams. A total of 127 miles of streams have been mapped in the project area. Streams range in size from small ephemeral draws to larger fish bearing streams such as the South Fork Touchet River. The following table illustrates miles of stream by Stream Type occurring within the study area.

Stream classification has been designated using WADNR Stream Type maps. Updates were completed information from Washington Department Natural Resources (WADNR) Forest Practices Division, field observation, and digital delineation using digital USGS quadrangle and orthophotographic basemaps. Figure 3 illustrates stream types and drainage network found within the project area.

The primary hydrologic influence associated with the South Fork Touchet River watershed is precipitation with occurrence of large flow events due to rain-on-snow events in the upper elevations. The combination of relatively shallow soils, a perpendicular orientation to storm front movement, and the elongated, trellis flow pattern can result in erratic fluctuations in stream flow.

Figure 3 Stream Types and Drainage Network

Table 3 Stream Classification

RAINWATER WILDLIFE AREA STREAM CLASSIFICATION	
Stream Type	
Stream Type*	**Stream Miles**
Type 1	0
Type 2	10
Type 3	8
Type 4	109

*Stream type definitions are those established by the WADNR Forest Practice Act under WAC 222-30-022. Type 1 streams are all waters, within their ordinary high-water mark, as inventoried as "shorelines of the state" under chapter 90.58 RCW. Type 2 streams are segments of natural waters that are not classified as Type 1 Water and have a high fish, wildlife, or human use. Type 2 waters are used by substantial numbers of fish for spawning, rearing , and/or migration. Type 3 streams are segments of natural waters that are not classified as Type 1 or 2 Water and have a moderate to slight fish, wildlife, and human use. Type 4 streams are perennial waters of nonfish-bearing streams. Type 5 stream include segments of natural waters within the bankfull width of defined channels that are not Type 1, 2, 3 or 4 Waters and which are seasonal nonfish-bearing streams

Distinct streamflow regimes can be determined from streamflow records. However, the South Fork Touchet Watershed is currently an ungaged watershed. Efforts are underway to establish a gaging station at RM 7.5 in cooperation with USGS and Washington Department of Natural Resources to provide streamflow data. In addition, CTUIR staff are currently conducting a study to assess channel morphology and restoration options along the South Fork Touchet with plans for restoration work to begin in 2004.

Streamflow exerts a strong influence on channel morphology, aquatic habitat, and riparian vegetation. Streamflow categories include: (E) ephemeral, (I) intermittent, (P) perennial, and (S) subterranean; with specific notations for streamflow patterns dominated by 1) snowmelt, 2) stormflow, 3) glacial melt, 4) spring-fed, 5) ice flows, 6) tidal influence, 7) regulated flow, 8) streamflow patterns altered by development. The South Fork Touchet River, Griffin Fork, and Burnt Fork have perennial streamflow regimes with variations in streamflow dominated primarily by snowmelt run-off. The Dry Touchet, a tributary to the South Touchet exhibits and intermittent flow regime. These streams have segments with subterranean flow, where water flows below and parallel to the ground surface.

Changes in flow regime for the study area are difficult to quantify without historical stream flow data. However, we assume there has been a shift in watershed hydrology in terms of peak flow timing, frequency, and magnitude, due in part to upland timber harvest within the study area and elsewhere within the South Fork subwatershed. Based on field observations of streambank stability, stream channel geometry, and floodplain conditions, a conclusion that the system has become more "flashy" and subject to weather conditions such as rain on snow events, is reasonable. Ongoing data collection efforts will assist in providing technical information necessary to accurately assess existing conditions and a reference condition that can be utilized to design and implement management actions.

Water Quality

Water quality monitoring was initiated in May 1998 by CTUIR staff. Initially, two Hobo thermographs were deployed in the South Fork Touchet River at rivermiles(RM) 7.5 and 10. Beginning in 1999, additional temperature probes were installed along the South Touchet at RM 13 and 13.5, and in the Griffin Fork at RM 0.1 and 1.50 to assess water temperatures in fish bearing streams throughout the wildlife area. Data collection efforts reveal that average summer baseflow water temperatures in the South Touchet are typically lower in the upper portions of the watershed and increase in the lower portion of the watershed. Average, highest seven day maximum temperature generally occur by August with highs of 25.7^0C (78.2^0F) at RM 7.5 and 24.9^0C (76.9^0F) at RM 10. Other study area streams such as the Griffin Fork, however, maintain relatively low water temperatures. Highest water temperatures recorded in this tributary also occur in August and generally do not exceed 17^0C (62.6^0F) near RM 1.5. Average maximum temperature has been about 12.8^0C (55^0F) during the 2000-2003 recording periods.

Temperature requirements for specific life history periods for the selected key fish species in the Walla Walla Subbasin are shown in the following table.

Table 4 **Upper temperature (°C) limits for life history periods of key fish species in the Walla Walla Subbasin (Hicks et al. 1999; Mallatt 1983)**

Life History Period	Steelhead	Spring Chinook Salmon	Bull Trout	Lamprey
Adult migration	< 21.5	< 22.5	< 22.0	< 20.0
Spawning	< 18.5	< 18.5	< 10.0	< 20.0
Embryonic development/ emergence	< 18.5	5.0–11.0	< 5.0	-
Juvenile rearing	< 21.0	< 21.5	< 13.0	< 20.0
Juvenile migration	< 21.0	< 21.5	< 14.5	-

Channel Morphology

Fish habitat surveys conducted in 1999 and 2001 can provide surrogate information for developing a preliminary morphological description of the South Fork Touchet and streams within the wildlife area. Approximately 10 miles of instream habitat survey was completed using methods developed by the Oregon Department of Fish and Wildlife (Moore, 1993). Additionally, Level 1 surveys (Rosgen, 1996) are currently underway to provide detailed information on existing channel morphological conditions and natural channel/floodplain design criteria for restoration/enhancement strategies.

The morphological description summary is based on the Rosgen (1996) stream classification, and is intended to be useful in identifying areas of sediment supply, stream reaches sensitive to disturbance, potential channel response to changes in flow regime, fish habitat potential, and potential for natural recovery (Rosgen, 1996).

Table 5 **Summary of Morphological Attributes of Fish Bearing Streams**

Attribute	South Fork Touchet	Griffin Fork
Segment Length (Mi)	7.0	3.0
Width/Depth Ratio	43.8	12.4
Sinuosity	>1.2	<1.2
Slope (%)	.08	1.6
Channel Material (%)		
Bedrock	0	3.0
Boulders	.01	.01
Cobble	23.0	23.0
Gravel	60.0	60.0
Sand	12.0	12.0
Silt/clay	5.0	3.0
Rosgen Classification	C	B

B-Channel Type - This channel type is described by Rosgen (1996) as channels that exist on moderately steep to gently sloped terrain, with the predominant landform seen as a narrow and moderately sloping basin. These types are moderately entrenched, have low channel sinuosity, and exhibit a "rapids"-dominated bed morphology. Bedform morphology, which may be influenced by debris constriction and local confinement, typically produces scour pools (pocket water) and characteristic rapids. Streambank erosion rates are normally low, as are the channel aggraation/degradation process rates. Pool-to-pool spacing generally decreases with slope increases.

The Griffin Fork and Burnt Fork, tributaries to the South Fork Touchet River, are typical "B" channel types and are best characterized as B4 channel, which includes which includes moderately entrenched systems in narrow, moderately steep, colluvial valleys, with gravel-dominated channel materials, and width/depth ratios greater than 12. This type is considered to be relatively stable and is not a high sediment supply stream. Large, woody, debris is an important component for fisheries habitat when available.

Based on the dominance of the channel material by cobble, these reaches might be categorized as B3 stream types. Channel bed morphology in these types is dominated by cobble materials and characterized by a series of rapids with irregular spaced scour pools. The average pool-to-pool spacing for this type is 3-4 bank-full widths. Pool-to-pool spacing is generally 4-5 bank-full channel widths. Pool to pool spacing adjusts inversely to gradient. This type has a moderate width/depth ratio and sinuosity greater than 1.2. Channel materials are composed primarily of cobble with a few boulders, lesser amounts of gravel and sand. The bed and bank materials are stable and contribute only small quantities of sediment during run-off events. Large woody debris is an important component of fisheries habitat when available.

C-Channel Type - These channel types are located in narrow to wide valleys, constructed from alluvial deposition. They have a well-developed floodplain (slightly entrenched), are relatively sinuous with a channel slope of 2% or less, and a bed-form morphology indicative of a riffle/pool configuration. Primary features of this type are a sinuous, low-relief channel, well-developed floodplains built by the river, and point bars within the active channel. Channel aggradation/degradation and lateral extension processes are dependent on the stability of streambanks, upstream watershed conditions, and flow and sediment regime. Channels of this type can be significantly altered and rapidly de-stabilized when the effects of imposed changes in bank stability, watershed condition, or flow regime combine to cause an exceedence of a channel stability threshold.

The South Fork Touchet River floodplain within the wildlife area is composed of a deep layer of alluvial material that was moved from the upper watershed and tributaries. Depositional processes through this stream reach are influenced by a combination of roughness elements in the stream and gradient changes. The removal or addition of large material within the active floodplain greatly influences the spatial and temporal distribution of fluvial sediments. Due to the high width/depth ratios, dominance of gravel as channel material, and gental slope, the South Touchet is best categorized as a C4 stream type. Rosgen (1996) describes these types as follows:

> These channel types have gentle gradients of less than 2%, a high width-depth ratio, and generally possess higher meander width ratios than C1, C2, C3 stream types. Streambanks are generally composed of unconsolidated, heterogeneous, non-cohesive, alluvial materials that are finder than the gravel-dominated bed material. Consequently, the stream is susceptible to accelerated bank erosion. Rates of lateral adjustment are influenced by the presence and condition of riparian vegetation. Sediment supply is moderate to high, unless stream banks are in a very low erodibility condition. This type, characterized by point bars and other depositional features, is very susceptible to shifts in both lateral and vertical stability caused by direct channel disturbance and changes in flow and sediment regimes of the contributing watershed.

Tributary Streams - Numerous, non-fish-bearing tributaries contributing to these streams are typically A-type channels. These channel types are generally ephemeral, flowing only in response to precipitation, or intermittent, flowing seasonally or sporadically. A-type channels are characterized as entrenched channels with low width/depth ratios, low sinuosity, and steep slopes generally ranging from 4 – 10%, and sometimes exceeding 10%. Dominant streambed materials include cobble, gravel, or residual soils for the A3, A4, and A5-Types. These types may provide relatively high sediment supply. The table below summarizes general characteristics of Rosgen (1996) stream classifications. Stream types occurring in the wildlife area are illustrated in **bold**.

Table 6 **Channel Type Management Interpretations (Rosgen 1996)**

Stream Type	Sensitivity to increases in: 1) streamflow magnitude, 2) streamflow timing, 3) sediment.	Recovery Potential	Sediment Supply	Streambank Erosion Potential	Vegetation Controlling Influence
A1	Very low	Excellent	Very low	Very low	Negligible
A2	**Very low**	**Excellent**	**Very low**	**Very low**	**Negligible**
A3	**Very High**	**Very Poor**	**Very High**	**Low**	**Negligible**
A4	Extreme	Very Poor	Very High	Low	Negligible
A5	Extreme	Very Poor	Very High	Moderate	Negligible
A6	High	Poor	High	Low	Negligible
B1	Very low	Excellent	Very low	Very low	Negligible
B2	Very low	Excellent	Very low	Very low	Negligible
B3	**Low**	**Excellent**	**Low**	**Low**	**Moderate**
B4	**Moderate**	**Excellent**	**Moderate**	**Low**	**Moderate**
B5	Moderate	Excellent	Moderate	Moderate	Moderate
B6	Moderate	Excellent	Moderate	Low	Moderate
C1	Low	Very Good	Very low	Low	Moderate
C2	Low	Very Good	Low	Low	Moderate
C3	**Moderate**	**Good**	**Moderate**	**Moderate**	**Very high**
C4	**Very High**	**Good**	**High**	**Very high**	**Very high**
C5	Very High	Fair	Very High	Very high	Very high
C6	Very High	Good	High	High	Very high

Floodplain and Instream Habitat Conditions

Although no historic quantitative stream physical habitat data exists for the study area, historical conditions were likely much different than present conditions. Overall habitat conditions are rated poor to fair with generally poor conditions in the South Fork Touchet River and fair conditions in the upper portions of Griffin Fork. Instream and riparian habitat in the study area has been dramatically impacted by past land management practices. Logging, road building, livestock grazing, and severe flooding events have altered hydrologic functions, instream and floodplain conditions, and successional stage and health of both upland and riparian plant communities.

Extensive road development within floodplains, along side streams, and on steep slopes have created slope instability, constrained floodplain function, and accelerated erosion and sediment delivery to fish bearing streams within the study area. Past logging, as evidenced by the abundance of large diameter tree stumps within the floodplain, coupled with flooding, removed structural stability and channel roughness, and altered groundwater elevations. Since the February 1996 event, there has been a substantial initiation of recovery as evidenced by the extensive resurgence of riparian shrub and tree seedlings, particularly black cottonwood. The following table summarized existing and desired watershed conditions.

Table 7 **Watershed Limiting Factors**

Watershed Limiting Factors, Existing Conditions, and Desired Conditions		
Element	Existing Condition	Desired Condition
Fish Passage	No man-made fish passage barriers present. Localized streamflow barriers present in localized areas.	Available passage to all fish bearing/suitable habitat.
Screen and Diversions	No current screens/diversions	Screens and diversions absent
Riparian Condition	Poor to Fair 1. Presence of drawbottom roads (limits riparian hab quantity) 2. Lack of and/or very early to early seral stages of hydrophytic vegetation 3. Canopy closure <40% 4. % Cover Hydrophytic Veg <9% 5. % Cover Deciduous <15%	1. Maximum potential for riparian habitat development and occupancy 2. Increase Mid and Late Seral to between 15 and 50% of area (see HRV in Table 8). 3. >70% 4. 50-80% 5. >50% 6. Site potential tree heights (Avg. > 40 ft.)

Watershed Limiting Factors, Existing Conditions, and Desired Conditions		
Element	Existing Condition	Desired Condition
	6. Avg. Ht. Vegetation <5 ft.	
Streambank Stability	Poor to Fair 1. 63% South Fk., 83% Griffin	1. > 80% South Fk (Rosgen "C" Channel), >90% Griffin Fk. (Rosgen "B" Channel)
Floodplain Connectivity/Entrenchment	Poor 1. Drawbottom roads, floodplain diking, stream fords. 2. Lack of stream channel equilibrium, excessive channel braiding	1. Reconnect stream to accessible floodplain by removing obstacles where feasible. 2. Facilitate development of single thread channel, appropriate sinuosity and gradient with reduced channel downcutting.
Width:Depth Ratio (Bank full)	Poor to Good 1. 43.8 South Fk., 12.4 Griffin Fk.	1. <29.3 South Fk., < 16.6 Griffin Fk. (Rosgen Averages for "C" and "B" channels respectively).
Substrate Embeddedness	No data	High quality spawning habitat
Large Woody Debris	Poor 1. 15 pcs./mile South Fk., 16 pcs./mile Griffin Fk. 2. Limited recruitment potential for several decades (early seral)	1. >60 pieces/mile large woody debris (>20 in dbh, length 1.5 x bankfull width)
Pool Frequency and Quality	Poor 1. Avg. 9 large pools/mile South Fk., Avg. 8 large pools/mile Griffin Fork.	1. Variable depending on channel type. >20 large pools/mile: channel morphology that maintains and develops suitable pool:riffle sequences
Off-Channel Rearing Habitat	Fair 1. Channel braiding providing off-channel rearing habitat	1. Single thread channel and more stable geometry to provide greater floodplain recovery associated healthy riparian area. Beaver recolonization over time would develop quality off-channel rearing.
Water Quality (Temperature) and Quantity	Poor to good 1. South Fk summer max approx 26^0C. 2. Griffin Fk summer max approx. 17^0C.	See Table 4.
Flow Regime	Poor to Fair 1. Poor summer baseflow (estimated at <3 cfs) in South Fk., and <1cfs in Griffin Fk. 2. Estimated shift in annual hydrgraph/peak flow events (frequency and magnitude) due to upland watershed condition	1. Unknown. DFC is to maximize summer baseflows and maintain perennial streamflow. 2. Unknown. Moderate frequency and magnitude of flood events. (Dependent on floodplain connectivity and riparian condition.
Biological Processes	Poor 1. Lack of beaver colonization 2. Lack of salmon and steelhead carcasses to recycle nutrients	1. Encourage recolonization of beaver to South Fk and Griffin Fk as successional development increases proportion of Mid seral stages 2. Increase salmon, steelhead, and other native fish in project area streams.

Soils

Soil plays a critical role in nutrient, water, and atmospheric cycles. Soil is essential for the development of plant communities and the animals that depend on them. Major sources for Columbia Basin soils include glacial till left from the last ice age, basalt erosion, wind-borne loess deposits, and volcanism (e.g., pumice and ash deposited from the eruption of Mount Mazama 7,000 years ago). According to the Soil Survey of Columbia County Area, Washington, U.S. Dept Agriculture, Soil Conservation Service (Natural Resource Conservation Service), December, 1973, the project area contains two primary soil associations: the Couse-Larkin Association and the Tolo-Gwin Association. Soil resource maps are contained in the project analysis file.

The Couse-Larkin Soil Association is predominantly found on gently sloping to steep slopes, are well drained, and moderately fine textured soils that formed in wind-laid silts, volcanic ash, and weathered basalt. Precipitation is generally 23 to 40 inches. This soil type is found primarily on Robinette Mountain within the project area.

The Tolo-Gwin Soil Association is found on strongly sloping to very steep slopes and are of medium-textured soils. This association includes rocky soils that formed in wind-laid silts and volcanic ash. Some of these soils are underlain by bedrock and are found on sites with 25 to 40 inches of annual precipitation. This soil association is found along the South Fork Touchet River, Griffin Fork and along steep slopes adjacent to these tributaries within the project area.

BIOLOGICAL ENVIRONMENT

The Walla Walla Subbasin is inhabited by 10 amphibian species, 207 avian species, 69 mammalian species, and 15 reptile species. A number of these species are of special concern to basin resource managers because of habitat loss and/or declining populations (see Threatened, Endangered, Sensitive, and Candidate Species section below). A comprehensive assessment of wildlife in the Walla Walla River basin is provided in the NPPC Walla Walla River Basin Subbasin Summary (NPPC, et al., 2001).

The wildlife area provides suitable habitat for a wide variety of Blue Mountain Province flora and fauna, but is probably best known for its quality big game hunting. The study area is located entirely within the WDFW Dayton Big Game Management Unit (#162) and has a resident elk population of between 80 to 120 animals. Mule deer, a target wildlife mitigation species, are also found with the project area. Mule deer populations in the unit are severely depressed (WDFW, 1998). Other game animals include white-tailed deer, black bear, cougar, blue and ruffed grouse, wild turkey, and California quail. The area also provides habitat for a wide variety of forest dwelling birds such as woodpeckers, owls, insectivorous birds, accipiters and other hawks, and eagles. A comprehensive overview of the biological environment for the wildlife area is presented in the Rainwater Wildlife Area Watershed Management Plan (Childs, 2002)

The study area contains approximately 6,744 acres forestland, 1,423 acres of grassland, 285 acres of upland shrubland, 596 acres of riparian forest, and 153 acres of riparian shrub. Forestland consists primarily of grand fir and Douglas-fir dominated timber stands with ponderosa pine occurring on south and southwest slopes. In their native states, grassland communities include Idaho fescue, bluebunch wheatgrass, and Sandberg's bluegrass. Primary shrublands include snowberry, wild rose, mallow ninebark, and ocean spray. Riparian plant communities include black cottonwood, sitka alder, willow, dogwood, and coniferous species.

Nearly 100 years of fire suppression, extensive timber harvest, and livestock grazing have shaped current vegetation conditions in the study area. In general, past management practices have increased the occurrence of earlier successional and structural stages and altered plant community composition.

The following sections describe existing plant communities in terms of composition and structure. Much of the information presented has been developed regionally by federal and state resource managers and ecologists. These techniques have been used to assess study area plant communities because they are scientifically based and provide a fundamental basis in which to evaluate existing conditions, identify limiting factors, develop desired conditions, and prescribe management techniques.

Cover Type Characteristics

Cover types within the wildlife area include forest, upland shrub, grassland, and riparian habitats and are described in this analysis using the plant association concept (Johnson Clausnitzter, 1994) and grouped within biophysical environments and potential natural vegetation communities. Cover types were defined using 1990 digital orthophotography, USGS 1:24,000 topographic quad maps, 1997 color aerial photography, field review, and professional judgment.

Cover type delineation included development of digital Geographic Information System (GIS) data themes and relational databases using ArcView. Plant association polygons were digitized based on broad cover types (e.g., forest, upland shrub, etc.) and adjusted based on aspect, slope position, and field verification. The relational database was coded for a variety of field attributes including stand (polygon) number, cover type, plant association, acreage, structural/successional stage, etc.

The Plant Association Concept

The plant community is a general term for an assemblage of plants living together and interacting among themselves in a specific location (Johnson and Clausnitzer 1992). It is not a taxonomic unit, has no successional status, and may not be recognized by all investigators. The plant association concept differs in that its purpose is to segment the temperature-moisture gradient through recognition of indicative plant species so as to provide easier recognition of similar environments across the landscape (Johnson and Clausnitzer 1992).

As a combination of similar or compensating environmental factors is repeated across the landscape (e.g. elevation, slope position, aspect), a predictable plant community will occupy those sites given time and varying frequencies of disturbance (Johnson and Clausnitzer 1992). This community will then have similar physiognomy (form and structure) and floristics; and may also be called a climax community (Allaby, 1994).

The plant association concept is based on the premise that:

1) The individual species in the association are, to some extent, adapted to each other;
2) The association is made up of species that have similar habitat requirements; and
3) The association has some degree of integration (Kimmins, 1997).

Because environmental conditions vary continuously across the landscape, the resulting plant composition also varies. For that reason, a plant association is not an exact assemblage of species from one location to another. However, sites in the same plant association differ less than sites from different associations (Powell, 1998). Plant associations are named for their dominant overstory (tree) and undergrowth (herb or shrub) plants, such as Abies Grandis/Clintonia plant association. It is assumed that the dominant tree species (Abies Grandis) represents an area's macroclimate, and the undergrowth indicator plant (Clintonia uniflora) the area's microclimate and soils.

Plant Series

Plant associations are grouped into series, which are aggregates of *taxonomically related* plant associations. The name of the series is that of the climax species dominating the principal layer. The naming convention is based on temperature/moisture regimes of the environment supporting the plant association. An example would be the *grand fir* series in which all ABGR plant associations are arrayed, as well as the seral plant community types related to grand fir climax vegetation (Johnson and Clausnitzer, 1994).

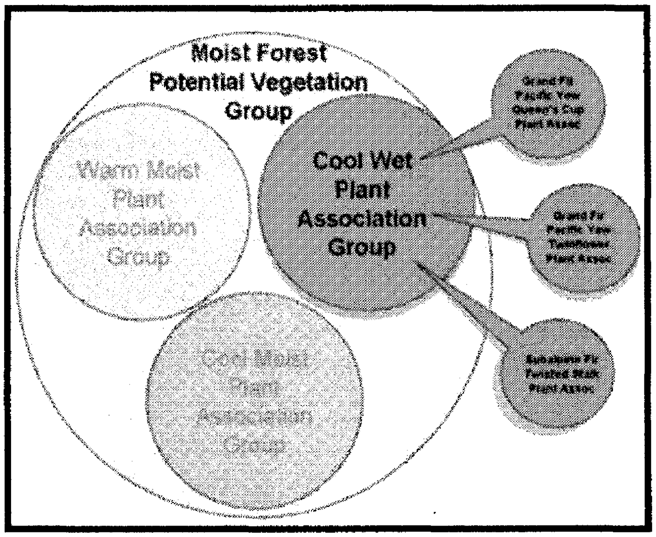
Plant Association Groups

Plant associations may be aggregated into plant association groups (PAG), classifications that similar *ecological environments*. A Grand Fir/Pacific Yew/Twinflower plant association would occur in the Grand Fir series, and would be grouped into the "*Cool Wet*" plant association group.

Potential Vegetation Groups

Finally, plant associations may be classified into Potential Vegetation Groups (PVG), a group of potential vegetation types that have similar *environmental conditions* and are dominated by *similar types* of plants. Groupings are often made using similar *life forms*. Continuing with the example, the "Cool Wet" PAG is located within the "*Moist Forest*" Potential Vegetation Group. This organization is illustrated in Figure X.

Figure 4 **Plant Association Organization**



Forest Cover Type Plant Associations

Forest cover types are generally located on north and east-facing aspects, resulting in a timbered stringer-grassland mosaic typical of the Blue Mountains. However, the Rainwater Wildlife Area also contains relatively large, flat, table lands associated with the ridgetop of Robinette Mountain that provides interior forest habitat types. The wildlife area contains approximately 5,000 acres of forested habitat. Forested plant associations observed during field surveys (n= number of observations) and their relation to plant association groups and potential vegetation groups are displayed in the following table. Detailed descriptions of each plant association are presented in Appendix X.

Table 8 **Forest Cover Type Plant Associations**

Potential Vegetation Group	Plant Association Group	Plant Association	n=
Moist Forest	Cool Very Moist	Grand fir/sword fern	2
	Cool Moist	Grand fir/beadlilly	4
	Cool Moist	Grand fir/Twinflower	1
	Warm Very Moist	Grand fir/Rocky mountain maple	6
	Warm Moist	Douglas fir/Pacific Oceanspray	7
	Warm Moist	Ponderosa Pine/Oceanspray*	2
Dry Forest	Warm Dry	Grand fir/Birchleaf spirea	1
		Douglas fir/Pine Grass	1
		Douglas fir/ninebark	10
		Douglas fir/Common Snowberry	6
		Ponderosa Pine/Common Snowberry	3

*This association with productive oceanspray growth in the absence of more mesic tree species is not yet classified. Its prevalence at elevations below 3,000' and the stature of oceanspray on these sites suggests it occurs higher on the moisture gradient than ponderosa pine/common snowberry, but lower than Douglas fir/oceanspray.

Upland Shrub Cover Type Plant Associations

Upland shrub cover types occupy approximately 285 acres of the study area. Predominant shrub associations include mallow ninebark/common snowberry and common snowberry/rose.

Table 9 Upland Shrub Cover Type Plant Associations

Potential Vegetation Group	Plant Association Group	Plant Association	n=
Moist Shrubland	Warm Moist	Common snowberry/rose Ninebark/common snowberry	10 5

Floodplain/Riparian Cover Type Plant Associations

The floodplain and associated riparian plant communities along the South Fork Touchet River are characterized as a typical fluvial valley with hydrophyic vegetation located in areas with shallow groundwater and inclusions of coniferous forest terraces and older gravel bars. Riparian plant communities include about 596 acres of riparian forest and 153 acres of riparian shrub. Dominant floodplain plant communities include Black Cottonwood/Snowberry, Douglas-fi/Snowberry, and Ponderosa Pine/Snowberry plant associations. Riparian shrub habitat consisting of alder and willow along stream channels and floodplain swales. Detailed descriptions of the associations listed in Table 12.

Table 10 Floodplain/Riparian Cover Type Plant Associations

Potential Vegetation Group	Plant Association Group	Plant Community	n=
Wet Riparian Forest	Warm Wet RF, Moderate soil moisture	Grand fir/Rocky Mtn. Maple – floodplain	4-5
	Warm Wet RF, Low soil moisture	Douglas-fir/common snowberry-floodplain	3-4
Dry Riparian Forest	Hot Dry RF, Moderate Soil Moisture	Black cottonwood/common snowberry - floodplain	1-2
	Hot Dry RF, Low Soil Moisture	Ponderosa pine/common snowberry – floodplain	2-3

Grassland Cover Type Plant Associations

Approximately 1,423 acres of grassland plant communities occur within the wildlife area. Surveyed plant associations include Bluebunch Wheatgrass/Sandberg's bluegrass and Idaho fescue /Bluebunch wheatgrass associations. Grassland communities typically occur on southern, southeast, southwest, and westerly slopes and ridgetops. Grassland communities within the wildlife area currently dominated by annual grasses as a result of past grazing.

Table 11 Grassland Cover Type Plant Associations

Potential Vegetation Group	Plant Association Group	Plant Association	n=
Moist Grassland	Warm Moist	Idaho Fescue/Bluebunch Wheatgrass	3
Dry Grassland	Hot Dry	Bluebunch Wheatgrass/Sandberg's Bluegrass	28

METHODS AND STUDY DESIGN

Habitat Evaluation Procedures (HEP) Concepts

HEP was developed by the US Fish and Wildlife Service to document the non-monetary value of fish and wildlife resources. Specifically, the quality and quantity of available habitat for selected wildlife species. HEP provides information for two general types of wildlife comparisons: 1) the relative value of different areas at the same point in time; and 2) the relative value of the same area at future points in time. By combining the two types of comparisons, the impact of proposed or anticipated land use changes on wildlife habitat can be quantified. HEP is based on ecological principles and the assumption that habitat for selected wildlife species can be described as a numerical value known as a Habitat Suitability Index (HSI). This value is derived from an evaluation of the ability of key habitat components to supply the life requisites of selected species of fish and wildlife. Evaluation involves using the same key components to compare existing habitat conditions with optimum habitat conditions for a target species.

The HSI value (ranging from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs) which are, for mitigation purposes, the "currency" used to measure/compare habitat losses and gains. Along with HEP, the USFWS developed and published "Blue Book Species Models." Eight USFWS models were used during this evaluation including: Downy Woodpecker (Picoides pubescens); Black-Capped Chickadee (Parus atricopillus); Blue Grouse (Dendragapus Obscurus); Western Meadowlark (Sturnella neglecta); Great Blue Heron (Ardea herodias); Yellow Warbler (Dendraica petechia); Spotted sandpiper (Actitis macularia); and Mink (Mustela vison). In addition, a recently published Mule Deer (Odocoileus hemionus) model (Ashley et al., 1999) was utilized in this evaluation to evaluate habitat for species of concern or wildlife species having significant cultural/recreational value.

Selection of evaluation species was based on loss assessments for the John Day and McNary dams. In general, a single HEP model is used to represent a guild of species for each cover type. Therefore, HSI values can represent the habitat quality for a range of species occupying the same habitat. In this evaluation, however, more than one model was utilized to the three primary cover types (e.g., forest, grassland, and riparian).

HEP Study Approach

CTUIR wildlife program staff coordinated HEP analyses for the Rainwater and Squaw Creek projects to reduce survey costs, minimize duplication of effort and standardize the assessment process for both projects. The HEP team leaders designed the evaluations based on the strategy described below:

1. Form a "core" HEP team.
2. Determine study goals and objectives.
3. Delineate study area boundaries.
4. Assemble available information (maps, soils data, aerial photos, land use and wildlife information).
5. Delineate cover types.
6. Select, develop and/or modify HEP models.
7. Developed field data collection team.
8. Develop site specific study design.
9. Collect field data.
10. Analyze field data
11. Report finding

The "core" HEP team was comprised of CTUIR project biologists Allen Childs and Eric Quaempts. The primary goal of the HEP team was to determine baseline habitat conditions and estimate habitat units on the wildlife area. Another important objective was to standardize cover type descriptions, habitat variable measurement techniques, and survey results for the Rainwater Wildlife Area and Iskuupla Watershed Project.

Study area boundaries were determined from project proposals submitted to BPA and then delineated on 1:24,000 US Geological Survey (USGS) maps. Project area information was obtained from a variety of sources including Washington Department of Natural Resources (WADNR), WDFW , Natural Resource Conservation Service, wildlife area biologists, tribal members, previous landowners, Rainwater Wildlife Area Advisory Committee members, and adjacent landowners and ranchers. Aerial photos, digital orth-quadrangles, and digital USGW quadrangle maps, soils data, hydrological data, and wildlife information was collected to support the baseline resource assessment.

Wildlife habitat cover types were defined in accordance with CTUIR, WADNR, WDFW, and USFWS guidelines. Cover type information was plotted on 1:24,000 GIS maps. HEP model selection was based on project area cover types and the models used in the loss assessments for the John Day and McNary Hydroelectric Projects (Rassmussen and Wright, 1990 b and d).

A field data collection team, comprised of personnel from CTUIR was assembled and briefed on study goals and objectives, HEP concepts and models, and the Rainwater and Squaw Creek project areas. Survey start points were determined prior to field data collection whenever possible. Transect route azimuths were randomly selected (random numbers table) and actual transect locations were recorded on a Trimble Global Position System (GPS) unit.

Prior to conducting field surveys, wildlife technicians were trained in the appropriate survey protocols for each model. Surveys were conducted consistent with Habitat Evaluation Procedures models for each species. To improve survey efficiency, an attempt was made to combine measurements for as many species' habitat variables as possible for each cover type. Surveys were conducted with teams of 2-4 technicians, generally with one team member recording data as other team member(s) conducted variable measurements, species identification, and ocular estimates of cover.

Habitat Surveys and Protocols

Forested and Upland Shrub Cover Type

The protocol for forested and upland shrub cover types was based on Habitat Evaluation Procedures (HEP) models for blue grouse and downy woodpecker. Habitat variables and measurement techniques are displayed in the following table.

Table 12 **Forest and Upland Shrub Cover Type Survey Variables and Measurement Techniques**

Species	Model Variables	Measurement Techniques
Blue Grouse	V2: Percent Shrub Crown Cover	Line intercept
	V3: Average Height Shrub Canopy	Line intercept, rod.
	V4: Percent Herbaceous Cover	Square Meter, Ocular Estimate
	V5: Average Height Herbaceous Canopy	Graduated Rod or Tape
	V6: Diversity Herbaceous Species	Count
	V7: Distance to Forest Cover	GIS Software
Downy Woodpecker	V1: Basal Area (Sq Ft)	Prism, 10 factor
	V2: Snags/Acre	Count within fixed radius plot

Starting points for line transects were generally established in a pre-field review. Line intercept transects were established at a starting point 300 feet within the cover type to avoid the influence of ecotone gradients and anthropogenic factors such as roads. Transects were a minimum of 1000 feet in length with 100 foot sub-segments. Final transect lengths were determined using a "running mean" to estimate variance, with a sampling goal of 95% probability of being within 10% of the true mean for percent herbaceous cover.

Shrub intercept, measured in 10ths of a foot (i.e. 1.6 feet), was recorded by species along entire transect. A graduated rod was used to measure shrub height where shrub foliage intercepted the transect line.

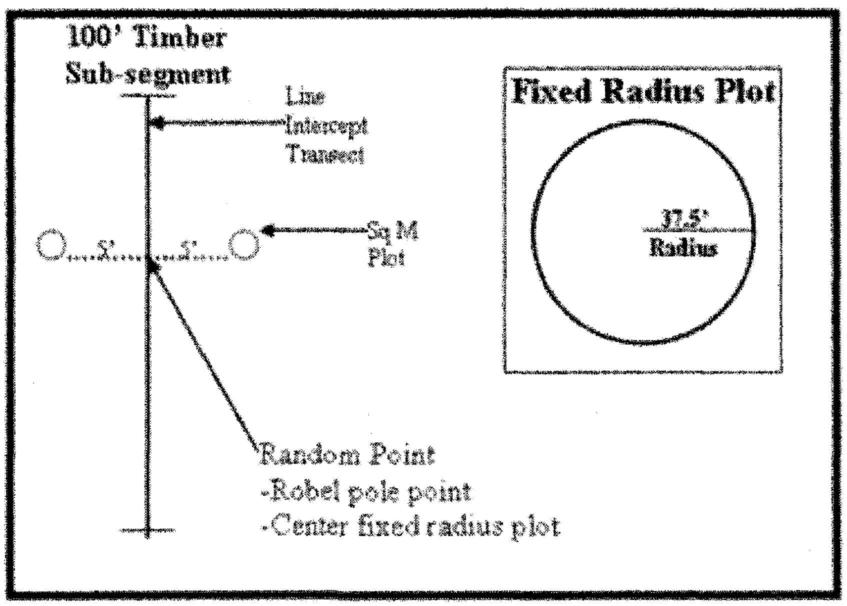
Circular plots and associated robel pole location points on transects were selected from a random numbers table. For example, if the first number selected from the random numbers tables was 23, then circular plot/robel pole measurements were taken at the 23rd ft mark of the first 100' sub-segment. Two square meter plots and one robel pole point were measured in each 100' sub-segment. The circular plots, used to make ocular estimates of herbaceous cover, were offset 5' perpendicular to the transect line. The robel pole was used to measure visual obstructions and hiding cover. At a distance of 15 feet, two measurements were taken from the transect line in opposite directions from the robel pole, and two measurements perpendicular to the transect line in opposite directions from the pole. For each point, the percentage of the robel pole obscured by vegetation or other cover was measured, then the mean obstruction value was calculated from the four measurements.

Tree basal area was measured from plot center using a factor 10 prism, and the square feet of basal area summed for the plot. Measurements were taken facing in the transect line direction of travel, then counts were made rotating clockwise, making sure to keep *prism* over plot center. Basal area was recorded for live trees only.

Tree canopy closure was recorded at 10 foot intervals along transect using moosehorn densiometer, and a running tally maintained for the entire transect length. Average canopy closure was calculated for each 100 foot intercept segment (i.e., 6 hits/10 readings = 60% canopy closure) and the entire transect.

Using the random numbers table as described above, fixed radius plot (37.5 feet) were established at random points on each 100' sub-segment of the transect. Facing transect origin, surveyors rotated clockwise and collected and recorded square feet of basal area and snags within the plot. For each plot, tree species, average tree diameter, and average tree height were recorded.

Figure 5 **Forest and Upland Shrub Survey Transect Diagram**



Floodplain/Riparian Cover Type

Table 13 Floodplain/Riparian Cover Type Survey Variables & Measurement Techniques

Species	Model Variables	Measurement Techniques
Yellow Warbler	V1: Percent Deciduous Shrub Crown Cover V2: Average Height Deciduous Shrub Canopy V3: Percent Shrub Canopy Composed of Hyrophytic Shrub	Line Intercept Line Intercept, Rod. Line Intercept
Downy Woodpecker	V1: Basal Area (Sq Ft) V2: Snags/Acre	Prism, 10 factor Plot Count
Mink	V1: Percent of year with surface water present V2: Percent Tree Canopy Cover V3: Percent Shrub Canopy Cover V4: Percent Canopy Cover of Emergent Vegetation V5: Percent Cover Trees/Shrubs w/in 100 meters of Water's Edge. V6: Percent Shore Line Cover w//in 1 M of High Water Mark.	USGS Guage, Fish Habitat Surveys Moosehorn Densiometer Line Intercept Line Intercept Moosehorn Densiometer Line Intercept
Great Blue Heron	V1: Distance between potential nest sites/foraging areas V2: Presence of water body with suitable prey population V3: Disturbance free zone w/in 100 meters of foraging area V4: Presence of tree cover type within 250 meters of water body V5: Presence of disturbance free zone around potential nest sites V6: Proximity of active/potential nest sites	Aerial Photo Interpretation Fish Population Surveys GIS Software GIS Software Aerial Photo Interpretation GIS Software

Initial survey starting points were identified during pre-field review, then finalized in the field by establishing line-intercept transects at the high water mark. Transects were run in 100 foot lengths with a total length of 1000 feet. Intercept was recorded in 10ths of feet (i.e., 1.6) for all objects providing hiding cover for mink (i.e., tree, shrub, grass, overhang, rock, etc) within 3 feet of high water mark.

Percent canopy closure was recorded at 10 foot intervals along transect using the moosehorn densiometer and maintaining a running tally for transect length. Average canopy closure was calculated by dividing the total number of tree canopy "hits" (when tree canopy obscured the center point of the densiometer) by the total number of readings taken (i.e., 6 hits/10 readings = 60% canopy closure).

At 250-foot intervals of the shoreline transect, 250-foot *lateral* transects were established at right angles to the shoreline in order to characterize the adjacent floodplain. Tree and shrub intercept and height were recorded on these lateral transects. The direction of subsequent lateral transects was alternated to characterize the floodplain on both sides of the stream (see Figure 2).

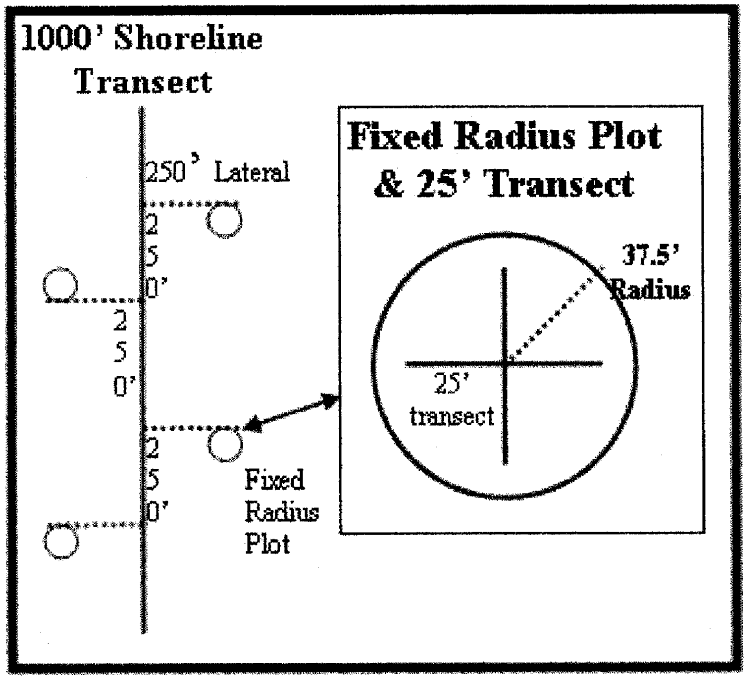
Recognizing that lateral migration of stream channels and stream sinuosity are natural factors that might limit floodplain widths to less than the lateral transect length, lateral transects were extended beyond the floodplain and up the adjacent toeslope 100 feet where necessary (i.e. when the adjacent floodplain was less than 250 feet wide).

Intercept measurements on lateral transects began at the edge of high water mark. Data was not recorded within the channel, and the width of the channel was not included in the 250' transect. Rather, lateral transect were initiated on opposite side of the channel at the high water mark.

Fixed radius plot (37.5 feet) were established at a random point on each lateral intercept. Square feet of basal area was measured for the plot, and a count of snags (> 6 feet high, > six inches in diameter).

Where vegetation (blackberry/other) presented a barrier to extending lateral transects a full 250 feet, a random point was established on the lateral to serve as the center of a fixed radius plot, and four 25 foot transects were established at 45 degree angles to collect line intercept data.

Figure 6 **Floodplain/Riparian Survey Transect Diagram**



Grassland Cover Type

The protocol for measuring grassland habitat variables is based on the western meadowlark HEP model. The following variable parameters measured to characterize grassland habitats:

Table 14 **Grassland Habitat Variables & Measurement Techniques**

Species	Model Variables	Measurement Techniques
Western Meadowlark	V1: Percent Cover Herbaceous Plants.	Square meter hoop
	V2: Percent Cover Composed of Grass.	Square meter hoop
	V3: Average Height Herbaceous Canopy.	Robel Pole
	V4: Distance to Perch Site.	Square meter hoop
	V5: Percent Shrub Canopy Cover.	Meter tape

Starting points for grassland surveys were established during pre-field reviews. Transect length was determined using a "running mean" to estimate variance with a sampling goal of 95% probability of being within 10% of the true mean for percent herbaceous cover. Every 50 meters, a square meter plot was established to measure cover values.

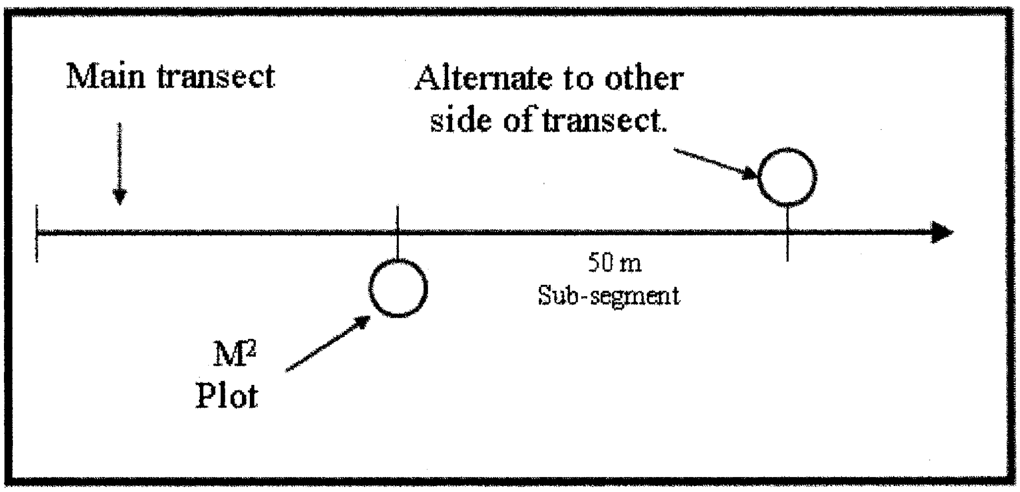
Square meter hoop plots were established perpendicular to main transect, offset by one meter, and placed on alternating sides of the main transect during the survey. The square meter hoop was used to provide a visual reference to allow surveyors to estimate percent cover of herbaceous plants by species, shrub canopy cover by species, and percent of plot composed of grass vs. non-grass species.

A meter tape was used to measure the distance to the nearest perch from plot center. Perch sites were defined to include rock outcrops, fence posts, shrubs, with a height greater than the measured average height of the herbaceous canopy within the square meter plot.

The robel pole was erected at plot center to measure visual obstructions/hiding cover. At a distance of 10 feet, two measurements are taken from the transect line in opposite directions from the robel pole, and two perpendicular to the transect line in opposite directions from the pole. For each point, surveyors determined the percentage of the robel pole obscured, and calculated a mean value for all four measurements.

The average and greatest height of the herbaceous canopy was measured within the plot using graduated rods or folding rule-tapes

Figure 7 Grassland Survey Transect Diagram



Office Methods

Transect and plot data were entered into spreadsheet s developed using Microsoft Excel. Data management and production of habitat suitability indices, habitat units, and tables were also accomplished using Excel.

Arcview Geographic Information Systems software, 1:24,000 USGS topographic data, and digital ortho-quad images was used to develop cover type maps and acreages for cover types and crediting classes. Some subjective analysis of cover type conditions was based on a combination of professional judgment and best available published literature. Details involving subjective analysis is detailed in the "Results – Baseline Habitat Indices and Units" section below for each wildlife mitigation species.

Transect and plot data were used to identify plant associations and communities provided in the "Biological Environment" section of this report. Published data for plant association structural characteristics was used to identify habitat limiting factors for wildlife mitigation species and to develop objectives for improving habitat suitability in the futures analysis.

HABITAT EVAULATION PROCEDURES RESULTS

Forest Cover Type Structural Characteristics

Field surveys in the forest cover type were completed August 30-October 22, 1999. Eighteen, 1,000 foot transects were surveyed with 360 square meter plots and 18 1/10th acre plots. Survey results are presented in the following tables. Data for upland and riparian forest cover types are presented separately to display differences in habitat conditions. The following figure illustrates survey transect and plot locations.

Table 15 Upland Forest Overstory Structural Characteristics

Transect	Tree Basal Area (Ft^2/Ac)	% Canopy Cover	Tree Height (ft)	Snags/Acre
1	20.20	32.00	53.20	0.20
2	12.50	0.25	22.67	0.20
3	15.00	30.00	29.40	0.60
4	81.20	92.00	54.60	0.60
5	117.80	80.00	55.20	1.60
6	18.20	90.00	73.60	0.00
7	126.00	60.00	55.60	1.00
8	96.00	68.00	57.60	1.60
9	110.00	68.00	55.20	1.00
10	42.00	62.00	57.40	0.20
11	104.00	52.00	49.40	0.80
12	55.00	42.50	67.00	1.00
13	73.33	20.00	69.67	0.33
14	60.00	44.00	42.00	1.40
16	29.57	30.00	54.25	1.25
17	98.00	64.00	46.60	1.00
18	36.00	34.00	42.20	1.80
19	24.00	10.00	22.20	1.20
Mean	**62.16**	**48.82**	**50.43**	**0.88**

Table 16 Upland Forest Understory Structural Characteristics

Transect	% Shrub Cover	Shrub Height (ft.)	% Herbaceous Cover	Diversity Herbaceous (#Spp.)
1	56.50	4.19	10.75	16.00
2	53.66	3.86	9.38	21.00
3	81.69	7.94	6.78	20.00
4	59.00	4.67	8.39	21.00
5	50.87	5.59	8.05	17.00
6	16.70	2.42	12.78	16.00
7	11.00	2.03	19.70	21.00
8	10.30	2.50	15.45	23.00
9	33.14	3.50	22.68	24.00
10	72.20	4.03	4.90	22.00
11	65.30	4.41	11.30	21.00
12	49.80	1.93	3.53	11.00
13	23.00	2.02	0.60	3.00
14	48.90	2.80	20.08	23.00
16	39.53	2.91	15.00	19.00
17	60.30	4.59	14.05	22.00
18	71.45	3.39	24.10	13.00
19	39.70	3.58	17.58	15.00
Mean	**48.80**	**3.68**	**12.5**	**18.2**

Table 17 Floodplain Forest Overstory Structural Characteristics

Transect	Tree Basal Area (Ft^2/Ac)	% Canopy Cover	Snags/Acre
1	90.00	38.00	2.00
2	60.00	9.00	0.00
3	80.00	20.00	1.00
4	210.00	4.00	0.00
5	160.00	31.00	2.00
6	80.00	24.00	1.00
7	160.00	48.00	0.00
8	110.00	0.00	0.00
9	10.00	16.00	1.00
10	230.00	50.00	1.00
11	210.00	33.00	1.00
12	200.00	32.00	0.00
13	190.00	75.00	2.00
14	190.00	34.00	5.00
16	120.00	39.00	0.00
17	120.00	82.00	1.00
18	220.00	83.00	1.00
19	220.00	74.00	0.00
Mean	**140.30**	**40.70**	**0.95**

Table 18 Floodplain Forest Understory Structural Characteristics

Transect	% Shrub Cover	Shrub Height (ft.)	% Herbaceous Cover	Diversity Herbaceous (#Spp.)
1	5.30	2.60	10.75	16.00
2	27.20	7.98	9.38	21.00
3	4.60	3.31	6.78	20.00
4	13.55	3.54	8.39	21.00
5	16.00	3.10	8.05	17.00
6	8.55	4.36	12.78	16.00
7	13.70	3.43	19.70	21.00
8	8.00	7.58	15.45	23.00
9	15.51	3.98	22.68	24.00
10	9.08	3.64	4.90	22.00
11	10.75	3.37	11.30	21.00
12	17.13	4.90	3.53	11.00
13	22.75	4.23	0.60	3.00
14	25.90	5.09	20.08	23.00
16	10.09	5.10	15.00	19.00
17	16.66	4.62	14.05	22.00
18	17.80	5.33	24.10	13.00
19	17.10	3.13	17.58	15.00
Mean	**13.75**	**4.44**	**12.5**	**18.2**

Downy Woodpecker

Baseline Habitat Suitability Indices and Habitat Units - The downy woodpecker model evaluates tree stocking, measured as basal area in square feet, and snag habitat (# of snags greater than 6 inches diameter at breast height per acre). The overall habitat suitability index in the model is the lower of the two life requisites. As shown in the following table, basal area in upland and forest cover types is at or near optimal while snag habitat is limited. See additional discussion below on habitat limiting factors. Average habitat suitability is rate poor at 0.15 and 0.20 for upland and riparian forest cover types, respectively.

Figure 8 Forest, Riparian, and Grassland Survey Transects & Plots

Table 19 Downy Woodpecker Baseline Habitat Suitability Indices and Habitat Units

Area and Habitat Suitability Indices	Evergreen Forest	Evergreen Forested Wetland*
Area (acres)	6,744.44	443.02
V1: Basal Area (Sq Ft/Ac)	1.0	0.50
V2: Number Snags/Ac (=>6" diameter)	0.15	0.20
H.S.I = Lower of V1 and V2	0.15	0.20
Relative Area	93.8%	6.2%
Weighted H.S.I =	(0.15)(.938)+(0.20)(0.062)	
Weighted H.S.I.=	**0.15**	
Baseline Habitat Units (0.15*7,187.46)	**1,100.3**	

*Floodplain Forest

Habitat Limiting Factors - Baseline habitat conditions for the downy woodpecker are limited primarily by snag habitat availability in both upland and riparian habitats (0.88 and 0.95 snags per acre, respectively). A minimum of 5 snags per acre is considered optimum in the model. Snag habitat is a dynamic habitat attribute with snag trees falling and living trees dying to become new snags. Snag-dependent wildlife require a continual supply of snag trees over time to meet their life history requisites.

To provide that continuum of snag habitat, future snags must be planned for by leaving green trees to eventually become snags in managed stands (Bull, et al 1997). Because woodpeckers are territorial, snags need to be distributed across the landscape to attain the maximum density of cavity nesters. Retaining snags close to living trees provides cover for cavity users that are less likely to nest in open areas (Bull, et al, 1997).

Snag tree longevity is an essential consideration in managing for snag habitat. Snag longevity is a function of many factors, including diameter and height, percentage of heartwood, cause of death, soil type and moisture, tree species, surrounding stand conditions, and prevalence of windstorms (Bull et al, 1997). Most studies suggest that 50% of ponderosa pine snags killed by fire or beetles fall within 10 years (Bull et al, 1997). Limited information is available on numbers of snags to retain for wildlife species in the interior Columbia Basin (Bull et al 1997). Thomas and others (1979) prescribed a snag density of 3 snags/acre greater than 6 inches in diameter for the downy woodpecker.

However, Thomas' management recommendations were based on a hypothetical, untested model, and did not consider snag tree recruitment needs. Research conducted by Bull et al., 1997, indicates that habitat needs of woodpeckers presented by Thomas and others (1979) is inadequate because of a lack of foraging strata and invalid assumptions used in the model. Three studies conducted in northeastern Oregon have shown that retaining foraging structure is essential, in addition to nest and roost trees (Bate 1995, Bull and Holhausen 1993, Dixon 1995).

Existing mean basal area is optimum in upland forest stands whereas riparian forest stands generally contain stocking rates greater than that considered optimal in the downy woodpecker model (currently 140 square feet/acre). Optimum tree stocking in the model ranges from 44-87 square feet per acre and the SI decreases to 0.5 when basal area exceeds 130 square feet. Despite historic and recent logging throughout the wildlife area that has created primarily second growth forests, stocking rates are not a limiting habitat variable for the downy woodpecker.

The following table illustrates a typical range of observed basal area in Blue Mountains forest stands for individual vegetation groups and plant associations. The values provide a basis from which to develop reasonable desired future conditions and expectations associated with variability in stocking rates in plant associations that occur within the wildlife area.

Table 20 **Basal Area Values (square feet per acre) for Selected Forested Plant Associations** (Johnson and Clausnitzer, 1992).

Potential Vegetation Group	Plant Association Group	Plant Association	n=	Basal Area Range	Mean Basal Area
Moist Forest	Cool Very Moist	Grand fir/sword fern	12	126-379	237
	Cool Moist	Grand fir/beadlilly	15	148-367	274
	Cool Moist	Grand fir/Twinflower	29	49-292	180
	Warm Very Moist	Grand fir/Rocky mountain maple	7	127-392	220
	Warm Moist	Douglas fir/Pacific Oceanspray	5	153-208	184
Dry Forest	Warm Dry	Grand fir/Birchleaf spirea	4	116-156	138
		Douglas fir/Pine Grass	18	79-182	115
		Douglas fir/ninebark	10	74-204	117
		Douglas fir/Common Snowberry	26	48-254	124
		Ponderosa Pine/Common Snowberry	16	76-243	155

Desired Future Condition - The DFC for downy woodpecker is to promote and maintain a minimum 60-80 square feet of basal area per acre on dry forest PVG's and 100-140 square feet of basal area on moist forest PVG's. An average of 5 snags per acre (>6 inches dbh) per acre will be available within 40 years.

The futures analysis is based on professional judgment and the best available information developed during the past several years. However, uncertainties exist in any futures analysis regarding natural processes that could result in dramatic and possibly catastrophic changes structural characteristics of forest cover types. Potential events such as large, uncontrolled wildfires and epidemic insect populations can devastate live tree inventory and habitat suitability indices for target wildlife species. Although it is recognized that these types of events could occur, determining realistic probabilities of actual occurrence would be difficult to accurately assess. For example, forest cover types located on Robinette Mountain exhibit a stand replacement fire regime. Under natural conditions, the forest would likely be consumed and regenerated by wildlife on average every 90 years. However, under the current management regime, fires are suppressed and the likelihood of a large stand replacement fire is limited. Conditions such as drought, occurrence of thunder storms, and initial response and suppression by firefighting crews will determine the size of a potential fire. Under the current management scenario, wildfires would likely be suppressed and kept to relatively small size. The net impact on structural conditions would therefore be minimal. Because of the uncertainties involves in predicting conditions and speculating about probabilities, is seems prudent in this analysis to assume that large, catastrophic events will not occur during the evaluation period and that any such changes would be addressed in updates to the analysis (scheduled on 10 year intervals).

Typical second growth timber stands located throughout the wildlife area will continue to develop towards a later seral stage with stem exclusion causing tree mortality, and thus snag recruitment as a result of competition for soil moisture and/or sunlight. Stem exclusion and/or management activities will generally result in larger diameter trees dominating individual timber stands over time compared to existing conditions. Other natural processes that may contribute to snag recruitment include root rot, endemic or epidemic populations of insects, floods, drought, and wildfire. These mortality agents may target different tree species and age classes; thus resulting in a mix of snag species and sizes across the landscape (Bull, et al. 1997). Natural events and decay processes that create dead tree habitat will maintain the snag resource through time. Maturation of forest stands and associated increases in stand basal area will eventually result in a decrease in H.S.I. for the basal area variable. According to the model, SI will decrease to a 0.50 value as basal area exceeds 130 square feet per acre. Site potential for the plant associations within the wildlife area provide tree stocking rates and associated basal area values at or near the upper level of the threshold in the model and are therefore considered appropriate values for the DFC.

Table 21 **Downy Woodpecker Futures Analysis Based on DFC (time=40 years)**

Area and Suitability Indices	Evergreen Forest	Evergreen Forested Wetland*
Area (acres)	6,744.42	443.02
V1: Basal Area (Sq Ft/Ac)	0.5	0.5
V2: Number Snags/Ac (=>6" diameter)	1.0	1.0
H.S.I. = Lower of V1 and V2	0.5	0.5
Relative Area	93.8%	6.2%
Weighted H.S.I.	(0.5)(.938)+(0.5)(.062)	
Weighted H.S.I. (0.3469 increase from baseline)	0.50	
Number of Predicted HU's	3,593.7	
Baseline Habitat Units	1,100.3	
Change in Habitat Units for t=40	**+2,493.43**	
Annual Change in Habitat Units (2,493.43/40)	**+62.34**	
10-Year Change in Habitat Units	**+623.4**	
Number Habitat Units in 10 Years	**1,723.7**	

Habitat Protection and Enhancement Strategies - Both passive and active habitat enhancement strategies are techniques that can be employed to protect and enhance habitat suitability and respective habitat units. Passive techniques include allowing sufficient time for forested stands to develop and produce the structural habitat qualities (i.e., basal area and snag habitat) that would benefit the downy woodpecker as well as other species. Habitat protection includes prohibiting woodcutting, conducting wildfire suppression, and designing/implementing management activities to achieve protection goals and objectives.

Types of potential enhancement strategies could include: 1) planting and precommercial thinning to facilitate forest stand development; 2) commercial thinning to maintain healthy timber stands and optimal basal area stocking and snag tree recruitment; 3) snag creation through fungal injections, girdling, and top blasting; and 4) obliteration and rehabilitation of skid trails and logging roads not needed to for future management to increase the acreage of forest cover type in production.

If stands are devoid of snags, a management strategy could include artificial snag creation (topping, girdling, fungal inoculation). Primary management considerations in creating snag trees include: 1) the target wildlife species for which the habitat is being created, 2) tree characteristics (species, size, habitat locality most likely to be used by the target species), and 3) the method of creating snag trees which are most likely to create long long-standing trees (Bull et al 1997). Bull and Partridge (1986) investigated six methods of killing ponderosa pine. The research determined topping trees with either a chainsaw or explosives produced snags that stood the longest and received the greatest nest use by woodpeckers. In the study, fungal inoculation and beetles attracted by pheromones did not consistently kill the tree. Trees killed by girdling or silvicides fell over too quickly to provide wildlife nest trees. Recent work by Parks and others (1996a, 1996b) documents a new method of inoculating live trees with decay fungi. Six years after inoculation of 60 living western larch, 14% contained woodpecker cavities near the inoculation site. These trees may stand for decades, with a pocket of decay that woodpeckers can utilize for nesting. These study results indicate that for western larch, inoculation produces desirable wildlife trees at a lesser cost than killing trees to create snags.

Retaining existing snags and ensuring adequate live trees are available for snag tree recruitment are considered the most ecologically sound and economical approaches to providing snag habitat (Bull et al 1997). Although existing snag availability is limited, natural recruitment potential is high throughout the wildlife area with very limited forest stands currently in an understocked condition. Endemic insect populations and disease, stem exclusion, lightning strikes and wildfire, and other processes that cause tree mortality coupled with snag habitat protection, will provide an improving trend in snag habitat conditions over time and ultimately contribute towards achieving the DFC without artificial manipulations.

Habitat protection strategies have been established in the wildlife area management plan (Childs, 2002), which will provide adequate protection of the snag habitat resource. The felling on any tree (live or dead) is prohibited and only down logs can be utilized by public users for campfires. In addition, the access and travel management plan limits potential access to the majority of forested stands by restricting public motorized travel to two primary roads including a 3 mile segment on Robinette Mountain and a 0.3 mile segment along the South Fork Touchet River.

Precommercial and commercial thinning activities identified in the management plan would be designed to meet target species habitat objectives and both short and long-term DFC's. Precommerical thinning is a management tool that can decrease competition and accelerate tree growth for cover habitat and snag tree recruitment. Commercial thinning activities would need to be carefully designed and implemented to ensure sufficient live tree recruits are available for future snag habitat. Research conducted by Bull et al 1997 which was incorporated into the Interior Columbia River Basin Eastside Management Plan (ICBEMP, 2000) indicates that at least 12 live tree recruits in moist PGV's and 6 live trees in dry PGV's needs to be retained throughout a timber stand management rotation to ensure snag habitat availability and viability of snag-dependant wildlife.

Black Capped Chickadee

Baseline Habitat Suitability Indices and Habitat Units - Habitat conditions for the black-capped chickadee are rated fair to moderate with average canopy closure slightly below optimum. Snag habitat availability is currently below optimum at less than 1 snag (4-10 inch dbh) per acre. The following table illustrates the baseline habitat analysis for this target species.

During riparian habitat surveys, tree heights were unintentionally omitted during data collection efforts. To address this issue, average tree height data collected from upland forested sites was extrapolated to forested floodplain cover types. The surrogate data is deemed acceptable because the same tree species (Douglas fir, ponderosa pine, and grand fir) occupy both upland and floodplain forest stands. While it is recognized that floodplain forest stands may be more productive (due to soil depth and available moisture) and therefore may produce taller trees, the SI curve for this variable is likely not sensitive enough to recognize differences in average tree height between the two sites (particularly when the SI's are weighted based on acreage).

Table 22 Black-Capped Chickadee Baseline Habitat Suitability Indices and Habitat Units

Area and Suitability Indices	Evergreen Forest	Evergreen Forested Wetland*
Area (acres)	6,744.44	443..02
V1: Percent Tree Canopy Cover	0.98	0.81
V1: Tree Height	1.0	1.0
V3: Number Snags/Ac (=>4-10 " diameter)	0.44	0.48
Relative Area	93.8%	6.2%
Weighted H.S.I	**0.44**	
Baseline Habitat Units (0.44 *7,187.46 ac)	**3,162.5**	

*Floodplain forest

Habitat Limiting Factors - Similar to the downy woodpecker model, the limiting habitat attribute for the black-capped chickadee is the availability of snag habitat. The snag habitat SI for the black-capped chickadee is higher than the downy SI due to different life history requirements identified in the models. Optimum snag habitat in the black-capped chickadee model is defined as 2 snags/acre, 4 to 10 inches dbh. For additional snag habitat discussion, see downy woodpecker section above. Both upland and floodplain forest cover types provide near optimum habitat suitability associated with canopy cover with a slightly lower SI value in the floodplain forest cover type. The following table, taken from Johnson and Clausnitizer (1992), illustrates measured ranges of tree canopy closure for forested plant associations occurring within the study area. Comparison of data collected through this analysis and ranges provided in the table indicates that canopy cover values are within expected ranges. Data presented for the various plant associations also indicate that canopy cover should be expected to increase over time without any large, stochastic event.

Table 23 Overstory Canopy Cover Values for Forested Plant Associations

Potential Vegetation Group	Plant Association Group	Plant Association	N=	Range (%)	Mean (%)
Moist Forest	Cool Very Moist	Grand fir/sword fern	12	45-90	72
	Cool Moist	Grand fir/beadlilly	15	41-115	83
	Cool Moist	Grand fir/Twinflower	29	41-140	77
	Warm Very Moist	Grand fir/Rocky mountain maple	7	44-98	71
	Warm Moist	Douglas fir/Pacific Oceanspray	5	35-70	57
Dry Forest	Warm Dry	Grand fir/Birchleaf spirea	4	47-123	73
		Douglas fir/Pine Grass	18	46-86	61
		Douglas fir/ninebark	10	10-84	48
		Douglas fir/Common Snowberry	26	19-92	53
		Ponderosa Pine/Common Snowberry	16	7-65	37

Desired Future Conditions - The DFC for the black-capped chickadee is for forested stands to provide greater than 50% canopy closure and greater than 2 snags per acre. Average tree heights would be greater than 46 feet. Canopy cover on dry forest PVG;s will generally provide a minimum of 35% canopy cover, with a corresponding SI of 0.7. Moist forest PVG;s will provide an average canopy cover of 50% with a corresponding SI of 1.0. Forested floodplains will provide an average of 5 snags per acre greater than 6 inches dbh within 40 years with a corresponding SI value of 1.0. The following table illustrates the futures analysis for the black-capped chickadee.

Table 24 Downy Woodpecker Futures Analysis Based on DFC (time=40 years)

Area and Suitability Indices	Evergreen Forest	Evergreen Forested Wetland*
Area (acres)	6,744.44	443.02
V1: Percent Tree Canopy Cover	1.0	1.0
V1: Tree Height	1.0	1.0
V3: Number Snags/Ac (=>4-10 " diameter)	1.0	1.0
Relative Area	93.8%	6.2%
Weighted H.S.I.	(1.0)(.938)+(1.0)(.062)	
Weighted H.S.I. (0.56 increase from baseline)	1.0	
Number of Predicted HU's	7,187.46	
Existing Habitat Units	3,162.47	
Change in Habitat Units for t=40	**+4,024.99**	
Annual Change in Habitat Units (4,024.99/40)	**+100.62**	
10-Year Change in Habitat Units	**+1,006.2**	
Number Habitat Units in 10 Years	**4,168.67**	

Enhancement Strategies - Habitat enhancement activities for the black-capped chickadee are the same as those described above for the downy woodpecker.

Blue Grouse

Baseline Habitat Suitability Indices and Habitat Units - The blue grouse was selected as a target species to represent the upland shrub cover type. Blue grouse are a culturally significant species and represent a cover type (upland shrub) that was not evaluated through other models utilized in this analysis. The blue grouse model was developed to evaluate several life requisites including forest and non-forest cover types (shrub and grass), and their spatial arrangement. However, since the downy woodpecker and black-capped chickadee models provide sufficient analysis for forested cover types, crediting for the blue grouse will be restricted to the upland shrub cover type

Baseline habitat conditions range from fair to good with the highest quality habitat located on Robinette Mountain, particularly along the ridges adjacent to canyon breaks in the Robison Fork, South Fork Touchet, and Griffin Fork canyons. Primary concerns associated with blue grouse habitat include availability of herbaceous cover and noxious/competing and unwanted vegetation (particularly in the grassland cover type). The following table presents baseline habitat conditions.

Table 25 Blue Grouse Baseline Habitat Suitability Indices and Habitat Units

Habitat Area and Variables	Upland Shrub
Area (acres)	284.9
V1: Canopy Cover Evergreen & Aspen (project area)	1.0
V2: Percent Shrub Crown Cover	0.63
V3: Average Height of Shrub Canopy (inches)	1.0
V4: Percent Herbaceous Canopy Cover	0.31
V5: Average Height of Herbaceous Canopy Cover	0.75
V6: Diversity of Herbaceous Vegetation	1.0
V7: Distance to Forest Cover Type	1.0
H.S.I Herbaceous Food/Cover Component	0.5
H.S.I Shrub Food/Cover Component	0.8
Relative Area	3.4%
Weighted H.S.I.	**0.48**
Number of Habitat Units	**136.8**

Habitat Limiting Factors – According to the blue grouse model, the primary habitat attribute limiting overall habitat suitability is V4, herbaceous canopy cover. Measured herbaceous canopy values in the upland shrub cover type are well below optimum conditions defined in the blue grouse model at 0.31. However, reference to literature from extensive research in Blue Mountain plant associations indicates that mid and late seral ninebark/common snowberry and snowberry/rose associations are normally dense enough to prohibit or minimize herbaceous growth (Johnson and Simon 1987). Optimum herbaceous cover in shrub communities with optimum shrub canopy cover defined in the model is normally not a condition observed in the field. Bluebunch wheatgrass, elk sedge, and yarrow are examples of herbaceous species that may be found in shrubland openings.

The following tables illustrate cover values for the two primary upland shrub communities found within the wildlife area. Observed values of percent cover in these plant associations are generally within the ranges presented.

SI values for other habitat variables are generally good with V3, V6, and V7 providing optimum conditions. As noted above, a primary concern in the wildlife area is the dominance of herbaceous cover by competing and unwanted vegetation such as non-native annual grasses and noxious weeds including yellow starthistle. Because HEP considers structural conditions, ecological issues associated with plant community composition, condition, and viability can be overlooked. Additional detailed discussion on this issue is presented in the Meadowlark section later in this report.

Table 26 **Ninebark/Snowberry Plant Association Cover Values, n=5 (Johnson & Clausnitzer, 1992)**

Species	Mean Cover (%)	Constancy (%)	Range of Cover (%)
Shrubs			
Ninebark	51	100	20-80
Snowberry	16	100	3-40
Serviceberry	3	100	1-7
Oceanspray	17	80	1-40
Spiraea	10	80	1-20
Rocky Mtn. Maple	2	60	1-3
Roses	7	60	3-10
Cherries	22	40	3-40
Syringa	2	40	1-2
Scouler willow	4	40	1-7
Herbaceous			
Bluebunch wheatgrass	11	100	1-40
Elk sedge	8	60	1-20
Yarrow	2	60	1-3
Red avens	1	40	1-1
Bedstraw	1	40	1-1

Table 27 **Snowberry/Rose Plant Association Cover Values, n=10 (Johnson & Clausnitzer, 1992)**

Species	Late Seral (n=3) Cover (%)/ Constancy (%)	Mid Seral (n=4) Cover (%)/ Constancy (%)	Early Seral (n=3) Cover (%)/ Constancy (%)	Total Range of Cover
Shrubs				
Snowberry	80/100	88/100	82/100	65-95
Rose	35/100	18/75	5/67	0 - 75
Herbaceous				
Idaho Fescue	1/33	1/25	3/67	0-5
Bluebunch wheatgrass	1/33	2/75	3/67	0-5
Japanese brome	-	10/25	-	0-10
Rattlesnake brome	-	5/50	30/33	0-30
White stemmed frasera	1/100	1/25	1/33	0-1
Red besseya	1/67	1/25	6/67	0-10
Red avens	5/33	1/25	3/67	0-5
Western hawkweed	1/67	2/50	3/33	0-3
Yarrow	1/67	5/25	8/67	0-15
Silky lupine	1/67	20/25	8/67	0-20
Common goatweed	10/33	1/50	15/67	0-25
Field chickweed	1/33	1/25	4/100	0-5
Gromwell	1/67	1/25	1/33	0-1
Goldenrod	5/33	1/50	3/33	0-5
Cleavers	5/67	22/75	38/100	0-60
Blue forget-me-not	-	6/50	2/100	0-10
Common speedwell	-	-	5/33	0-5
Tonella	-	1/25	39/67	0-75
Miner's lettuce	1/67	-	40/100	0-60

Desired Future Conditions - The DFC for blue grouse is to maintain greater than 40% evergreen canopy cover (forest cover type), moderate shrub cover, greater than 40% herbaceous canopy cover, and quality edge habitat. Potential habitat enhancements include restoration of native grasslands, controlling noxious weeds and competing and unwanted vegetation, promoting forest stand treatments that increase the proportion of mid and late seral stages, and obliteration of roads in forestland, grassland, and riparian cover types. Because crediting for blue grouse habitat units is limited to the upland shrub cover type, desired future conditions for the species will be limited to the upland shrub cover type as well.

Shrub Cover Characteristics

Shrub crown cover will remain relatively high in the ninebark/snowberry plant association, generally ranging from 20-80% depending on the seral state of a particular site. Within four years of events such as wild or prescribed fire, shrub cover will range from 20-40% with shrub heights of two to three feet. Five or more years after such a disturbance event, shrub cover will range from 40-80% cover and average shrub height will be equal to or greater than three feet in height.

Herbaceous Cover Characteristics

Diversity of herbaceous species in shrublands will remain high with eight or more species. Overall cover values, however, will remain relatively low due to a high percent of overstory shrub cover. Herbaceous canopy closure will range from 30-50% in early seral stages (< 4 years) and decrease to an estimate4d 5-30% in later seres as shrub canopy closure increases. Average height of the herbaceous canopy will be determined by herbaceous species present.

Table 28 Blue Grouse Futures Analysis Based on DFC (time=40 years)

Habitat Area and Variables	Upland Shrub
Area (acres)	284.9
V1: Canopy Cover Evergreen & Aspen (project area) 1.0	1.0
V2: Percent Shrub Crown Cover .63	.33
V3: Average Height of Shrub Canopy (inches) 1.0	1.0
V4: Percent Herbaceous Canopy Cover .31	0.5
V5: Average Height of Herbaceous Canopy Cover .75	0.75
V6: Diversity of Herbaceous Vegetation 1.0	1.0
V7: Distance to Forest Cover Type 1.0	1.0
Relative Area	3.4%
H.S.I. Herbaceous Food/Cover Component	0.6
Number of Predicted Habitat Units	170.94
Existing Habitat Units	142.45
Change in Habitat Units for t=40	**+28.49**
Annual Change in Habitat Units 28.49/40)	**0.71**
10-Year Change in Habitat Units	**+7.12**
Number Habitat Units in 10 Years	**150**

Enhancement Strategies – Habitat suitability for blue grouse can be protected and enhanced by continuing efforts to control trespass livestock (boundary fence construction and herding) and associated grazing, conducting weed control efforts to reduce noxious and competing and unwanted vegetation to encourage restoration of native/native like grassland communities, protecting streams, springs, and wetland meadows, managing forest resources to maintain roosting and overwintering habitat, and conducting prescribed burning. Forest management activities such as reforestation and thinning can be designed to address the needs of blue grouse. Maintaining open, parklike forest stands along ridge tops provide optimum habitat conditions for blue grouse (Johnsgard 1973, Zwickel and Bendell). Forbs should always be included in seed mixes when reseeding forest land and range where blue grouse occur (Seaburg 1966). Mussehl (1962) showed that blue grouse preferred sites composed of at least 11% forbs. Openings in densely forested areas are important to blue grouse and forest management activities be designed to create small openings which may improve breeding habitat. Cade (1984) recommended using clearcuts smaller than 250 m (820 ft) across and leaving at least 40 trees/ha (16 trees/ac) that have a minimum 24 cm (9 in) diameter on wintering areas. Selective cuts or long rotations greater than 60 years are also better for wintering blue grouse than clearcuts (Cade and Hoffman 1990). Winter roost areas should be retained, including mature, mistletoe-laden Douglas fir thickets near ridges.

Periodic use of prescribed fire as a management tool in shrublands would provide a mosaic of shrub and herbaceous cover stands. Shrub canopy closure would decrease following a prescribed fire treatment with an associated increase in herb aceous canopy. However, most of the shrub species that occur within the plant associations would respond favorably to fire with vigorous sprouting and return to dominance (Johnson and Clausnitzer, 1994). New shrub shoots would provide high quality forage resources for a variety of wildlife. The ninebark/common snowberry plant associations are likely the result of past fire in Douglas-fir/ninebark plant associations with shrubs limiting subsequent tree establishment (Johnson and Clausnitzer, 1992).

Floodplain/Riparian Cover Type Structural Characteristics

Riparian habitat surveys were initiated October 13, 1998 and completed by November 18, 1998. Tweny, 1,000 linear foot transects, 73, 100-250 foot lateral transects, and 80, 1/10th acre plots were completed to characterize the shrub and tree layers of the floodplain. Survey results for riparian structural characteristics are summarized by transect and habitat parameter in the table below.

Table 29 Riparian/Floodplain Structural Habitat Conditions

Transect	Tree Canopy Closure (%)	Tree Basal Area (Ft^2/Ac)	Snags/ Ac	% Shoreline Cover	Total % Shrub Cover	%Cover Hydrophytic Shrubs	Avg. Shrub Height (Ft.)	% Cover Deciduous Vegetation	Avg. Height Deciduous Vegetation (Ft.)
1	38.00	90.00	2.00	81.70	5.30	6.00	4.00	5.70	3.58
2	9.00	60.00	0.00	74.40	27.20	15.60	10.60	24.23	10.34
3	20.00	80.00	1.00	76.90	4.60	5.60	2.82	6.90	2.63
4	4.00	210.00	0.00	38.50	13.55	0.14	3.56	17.15	3.87
5	31.00	160.00	2.00	54.70	16.00	7.50	9.96	14.70	3.26
6	24.00	80.00	1.00	50.90	8.55	2.40	3.92	8.55	4.36
7	48.00	160.00	0.00	79.80	13.70	5.30	2.92	13.70	3.43
8	0.00	110.00	0.00	24.70	8.00	6.50	6.38	11.60	7.58
9	16.00	10.00	1.00	68.40	15.51	5.10	4.75	17.21	5.48
10	50.00	230.00	1.00	100.00	9.08	9.87	2.93	10.98	2.73
11	33.00	210.00	1.00	56.20	10.75	7.30	2.91	10.75	3.37
12	32.00	200.00	0.00	60.70	17.13	10.13	3.98	17.75	4.90
13	75.00	190.00	2.00	89.70	22.75	25.55	3.56	26.95	3.84
N	34.00	190.00	5.00	53.80	25.90	19.10	3.88	38.40	4.58
15	39.00	120.00	0.00	57.00	10.09	7.59	5.27	10.83	6.42
16	82.00	120.00	1.00	92.60	16.66	11.10	3.90	18.66	4.62
17	83.00	220.00	1.00	91.10	17.80	16.40	4.44	19.10	4.69
18	74.00	220.00	0.00	97.60	17.10	12.20	4.67	17.60	5.10
19	73.00	140.00	0.00	92.10	10.40	8.20	4.70	10.40	4.94
20	49.00	6.00	1.00	73.20	4.93	3.50	3.89	5.53	4.00
Mean	**40.70**	**140.30**	**0.95**	**70.70**	**13.75**	**9.25**	**4.65**	**15.33**	**4.69**

Great Blue Heron

Baseline Habitat Suitability Indices and Habitat Units – This model evaluates the availability and arrangement of foraging and nesting habitat provided by floodplain and riparian habitat as well as the proximity of suitable nesting habitat in relation to existing heron rookeries through six habitat parameters. The baseline assessment is presented in the following table. Suitable great blue heron habitat within the wildlife area is located primarily along the South Fork Touchet River and Griffin Fork watershed. Great blue herons utilize wetlands, floodplain/riverine habitat, and agricultural land. They are found throughout Washington, but are most common in the lowlands. Great blue herons are colonial breeders that nest in a variety of deciduous and evergreen tree species. Nests are usually constructed in the tallest trees available (Jensen and Boersma 1993). Herons feed on a wide variety of aquatic and marine animals found in shallow waters as well as mice and voles (Calambokidis et al. 1985, Butler 1995). Great blue herons are generally sensitive to human disturbance (Parker 1980, English 1978), and colonies have been abandoned in response to housing and industrial development, highway construction, logging, vehicle traffic, and repeated human intrusions (Leonard 1985, Parker 1980, Kelsall and Simpson 1979, Werschkul et al. 1976). Other studies suggest that great blue herons may habituate to non-threatening repeated activities (Webb and Forbes 1982, Vos et al. 1985, Calambokidis et al. 1985, Shipe and Scott 1981). Thus, different great blue herons may have different tolerance levels to disturbance depending on disturbance history and type (Simpson 1984).

Table 30 Great Blue Heron Baseline Habitat Suitability Indices and Habitat Units

Habitat Area and Variables	Forested Wetland* (Site 1)	Forested Wetland* (Site 2)
Area (Acres)	227	369
V1: Distance between potential nest sites & foraging areas	1.0	1.0
V2: Presence of water body with suitable prey population	1.0	1.0
V3: Disturbance-free zone up to 100 meters around potential foraging areas	0.62	1.0
V4: Presence of tree cover type within 250m of wetland	1.0	1.0
V5: Presence of 250m (land) or 150m (water) disturbance-free zone around potential next sites	0.62	1.0
V6: Proximity of potential nest site to active nests	0.10	0.10
Relative Area	38.1%	61.9%
Weighted H.S.I (.381*0.0)+(.619*0.3) =	**0.20**	
Number of Habitat Units (0.20* 596) =	**119.2**	

*Floodplain Forest.

Habitat Limiting Factors – Primary limiting factors for the great blue heron within the wildlife area include: 1) disturbance free zones adjacent to feeding and nesting areas (V3 and V5); and 2) proximity of potential next sites to active next sites (V6). An approximate 3 mile road segment along the South Fork Touchet River is currently open to public motorized travel to provide access to a private land parcel in the central, western portion of the wildlife area. Other floodplain roads in the upper reaches of the South Touchet and Griffin Fork were closed and/or decommissioned in 2000 and 2001 to reduce wildlife disturbance and protect habitat. Short and Cooper (1985) characterized a "disturbance-free" zone as potential foraging areas that are generally free from human disturbances during the four hours following sunrise and preceding sunset. Habitat suitability is scored as "1.0" if there is usually no human disturbance near the potential foraging or the foraging zone is generally about 100 meters from human activities and habitation or about 50 meters from roads with occasional, slow-moving traffic. The suitability is scored as "0.0" if the above conditions are not met.

For the V3 model variable, the lower 3 miles (227 acres, 38.1%) does not meet the definition of disturbance free zone. Habitat suitability for this area is rated as 0.0. About 369 acres (61.9%) in the upper South Touchet and Griffin Fork where roads have been closed and/or decommissioned meet the criteria for disturbance free zone. These areas were rated with a habitat suitability of 1.0.

Proximity of potential next sites to active next sites (V6) is also a habitat-limiting factor. This model variable is determined by measuring a straight line-distance between active and potential next sites. The only known heron rookery in the Touchet River subbasin is located on the Touchet River about 30 kilometers from the wildlife area. Suitable nesting habitat for establishment of heron rookeries is generally available throughout the subbasin with large stands of cottonwood galleries along the Touchet River and South Fork Touchet River. These stands may be utilized to establish rookeries in the future, be we have have no predictive ability to estimate when such use might occur, what the distance to the rookery might be, and what the subsequent change in suitability for V6 may be.

Desired Future Conditions - In 40 years, habitat suitability for the great blue heron will be similar to current conditions. Habitat enhancement and restoration activities including additional road decommissioning, improved natural channel morphology, and increases in fish populations will likely have a positive influence on availability of forage fish and large diameter trees suitable for nesting habitat.

Table 31 Great Blue Heron Futures Analysis Based on DFC's (time=40 years)

Habitat Area and Variables	Forested Wetland* (Site 1)	Forested Wetland* (Site 2)
Area (Acres)	227	369
V1: Distance between potential nest sites & foraging areas.	1.0	1.0
V2: Presence of water body with suitable prey population.	1.0	1.0
V3: Disturbance-free zone up to 100m meters around potential foraging areas.	0.0	1.0
V4: Presence of tree cover type within 250m of wetland.	1.0	1.0
V5: Presence of 250m (land) or 150m (water) disturbance-free zone around potential nest sites.	0.0	1.0
V6: Proximity of potential nest site to active nests.	0.1	0.1
Relative Area	38.1%	61.9%
Weighted H.S.I.	**0.20**	
Estimated Habitat Units for t=40	**116.7**	
Existing Habitat Units	**116.7**	
Change in Habitat Units for t=40.	**0**	
Annual Change in Habitat Units	**0**	
10-Year Change in Habitat Units	**0**	
Number Habitat Units in 10 Years	**119.2**	

Enhancement Strategies – Disturbance in the lower reaches of the South Touchet could be reduced by closing roads to public motorized access. However, because the road segment provides access to a private landowner, some road-related disturbance will be present in this area for the foreseeable future. Although unknown at present, we anticipate an opportunity to relocate the lower 3 miles of the existing road along the South Fork Touchet River, which could potentially increase the SI for variables V3 and V5 in Site 1 to 1.0. In the short-term, the road segment will be closed to general public use, which will decrease road-related disturbance in the area. However, the model does not provide an SI curve for these two variables and are either assigned 0.0 or 1.0. For the analysis at this time, a reasonable estimate of changes in habitat suitability would be that Site 1 would provide disturbance free zones similar to the existing condition (SI = 0.0 for V3 and V5).

The distance to the nearest active rookery is not a variable that can be readily addressed through management actions other than protecting existing, potential nest habitat, and promoting hardwood and coniferous forest establishment and growth (tree planting, thinning and protection) where it is currently lacking.

Yellow Warbler

Baseline Habitat Suitability Indices and Habitat Units - The Yellow Warbler model has three variables; 1) percent deciduous crown cover, 2) average height of deciduous shrub canopy, and 3) percent of deciduous shrub canopy comprised of hydrophytic shrubs. Hydrophytic vegetation is defined as follows:

> "*Hydrophytic Vegetation* - The sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Corps of Engineers Wetland Delineation Manual, 1987)."
>
> "*Hydrophyte - Any macrophyte that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.*"

Determining hydrophytic vegetation requires identifying plant species that occur in wetlands at minimum levels of probability, and determining the dominance of those species for each vegetative stratum (i.e. herbaceous, shrub, or tree). The Corps of Engineers Wetland Delineation Manual (1987) was referenced for determination of hydrophytic vegetation. The Manual provides the following criteria:

More than 50% of the dominant plant species from all strata (herbaceous, shrub, tree) are obligate wetland plants (OBL), facultative wetland plants (FACW), or facultative plants (FAC).

> **OBL** – Obligate wetland plants. Plants that occur almost always (estimated probability > 99%) in wetlands under natural conditions, but which may also occur rarely (estimated probability <1% in non-wetlands).
>
> **FACW** – Facultative wetland plants. Plants that occur usually (67% < probability <= 99%) in wetlands, but also occur (1% < probability <= 33%) in non-wetlands.
>
> **FAC** – Facultative plants. Plants with a similar likelihood (33% probability 67%) of occurring in both wetlands and non-wetlands.

For each stratum in the plant community, dominant species are the most abundant plant species (when ranked in descending order of abundance and cumulatively totaled) that immediately exceed 50% of the total dominance measure for the stratum, plus any additional species comprising 20% or more of the total dominance measure for the stratum.

Table 32 Sampled Hydrophytic Plant Species

Species Code	Common Name	Designation*
ACGLG	Rocky Mtn. Maple	FAC
ALSI	Alder	FACW
AMAL	Serviceberry	FACU
COSES/COST	Red Osier Dogwood	FACW
CRDO	Hawthorne	FACW
HMAL	Blackberry	FACU
POTR2	B. Cottonwood	FAC
SALIX	Willow spp.	FAC/OBL
SARA/SARA2	Black elderberry	FACW

*Reed, 1998.

Table 33 Yellow Warbler Baseline Habitat Suitability Indices and Habitat Units

Habitat Area and Variable	Deciduous Shrubland
Area (Acres)	153.3
V1: Percent shrub canopy.	0.26
V2: Average shrub height.	0.71
V3: Percent of deciduous shrub canopy comprised of hydrophytic shrubs.	0.18
H.S.I.	0.18
Number of Habitat Units	**27.6**

Habitat Limiting Factors – The availability of shrub canopy and percentage of hydrophytic shrubs currently limits yellow warbler habitat within the wildlife area. Low SI's for V1 and V3 are attributed primarily to past management practices such as road construction, logging, and livestock grazing which have contributed to altered stream channel morphology, reduced floodplain function, and decreased hydrophytic plant communities. These factors combined have altered the ability of the extensive floodplains associated with the South Touchet and Griffin Fork to propagate and sustain mid and late seral hydrophytic plant communities. Observed field conditions include floodplain confinement by drawbottom roads, lateral channel migration and channel incision, gravel bar formation, and streambank erosion which negatively influences establishment of stable hydrophytic plant communities such as willow, alder, black cottonwood, red osier dogwood, and hawthorne. In addition, late season trespass livestock grazing inhibits shrub growth and establishment.

Desired Future Conditions – Shrub communities will provide a minimum deciduous shrub cover value of 50%, with 70% of the shrub layer composed of hydrophytic species. Shrub heights will average 6 feet or more.

Table 34 Yellow Warbler Futures Analysis Based on DFC's (t=10)

Habitat Area and Variable	Deciduous Shrubland
Area (Acres)	153.3
V1: Percent shrub canopy.	0.81
V2: Average shrub height.	1.0
V3: Percent of deciduous shrub canopy comprised of hydrophytic shrubs	0.48
Habitat Suitability Index	0.75
Estimated Habitat Units in t=10 years	114.3
Existing Habitat Units	27.6
Change in Habitat Units	**+86.2**
Annual Change in Habitat Units (86.2/10)	**8.62**
10-Year Change in Habitat Units	**+86.2**
Number Habitat Units in 10 Years	**113.8**

Enhancement Strategies – Yellow warbler habitat will be enhanced through a combination of restoration and enhancement strategies including: protection from livestock grazing, road decommissioning, road drainage repair, and floodplain/riverine treatments that promote establishment of stable stream channels. In addition, planting of hydrophytic shrubs following treatments such as road decommissioning will contribute towards providing high quality warbler habitat. Prohibiting livestock grazing will reduce browse pressure and allow shrub canopy cover to increase. Large wood additions to stream channels and where necessary development of channel meanders, removal of floodplain roads/dikes will increase sediment storage within the floodplain, increase channel sinuosity, and associated water storage area. This in turn will facilitate the establishment and development of riparian vegetation, including deciduous and hydrophytic shrubs.

Mink

Baseline Habitat Suitability Indices and Habitat Units – Riparian and floodplain habitat surveys in the Rainwater Wildlife Area unintentionally omitted collected of data for the V4 model variable (Percent cover emergent vegetation). For the baseline condition, it is estimated that less than 5% of the floodplains along the South Touchet, Griffin Fork, and major tributaries contain emergent vegetation. This estimate is based on field review, aerial photo interpretation, and professional judgment. An SI of 0.1 has been assigned to this variable.

Baseline habitat conditions for the mink are rated fair to good with V1, V2, V5, and V6 rating higher than 0.5. An overall baseline habitat suitability of 0.75 was determined through the modeling process. The following table presents the baseline assessment.

Table 35 Mink Baseline Habitat Suitability Indices and Habitat Units

Habitat Area & Variables	Riparian/Forest Shrub < 405 ha
Area (acres)	596
V1: Percent of year with surface water present.	1.0
V2: Percent tree canopy cover.	0.6
V3: Percent shrub canopy cover.	0.3
V4: Percent canopy cover of emergent vegetation.	0.1
V5: Percent canopy cover trees/shrubs <= 100m waters edge.	0.5
V6: Percent shoreline cover <= 1m of water's edge	0.7
Water SI = V1	1.0
Cover SI = $(V5+V6)^{\wedge 1/2}$	0.75
Lowest life requisite value (lower of water SI or cover SI).	0.75
H.S.I.	**0.75**
Number of Habitat Units	**447**

Habitat Limiting Factors – Primary habitat limiting factors for mink habitat suitability include percentage of shrub canopy cover and availability of emergent vegetation. Similar to conditions described for the yellow warbler earlier in this report, past management activities have shaped the current condition of floodplain and riparian plant communities. Early seral riparian/hydrophytic shrub communities dominate shrub conditions and current limit habitat suitability for riparian dependent wildlife. In addition, emergent wetland plant communities are also limited in the baseline condition.

Desired Future Conditions – The DFC for floodplain/riparian habitats is to promote conditions that support 50-80% shrub canopy cover with 70% of the shrubs composed of hydrophytic species. It is estimated that total shoreline cover will average 80%. Habitat protection and enhancement activities will result in an increase in floodplain/channel stability and associated hydrophytic shrub communities over time. Primary hydrophytic plant species include black cottonwood, alder, willow, red osier dogwood, and black hawthorne.

Existing floodplain and riparian habitat conditions are believed to be much different than historic conditions. Since 1998, project staff have observed significant changes in floodplain and riparian conditions for a large flood event in 1996 and initiation of livestock exclusion, road decommissioning, and limited instream habitat enhancement (large wood additions) since the 1998 land acquisition. Although the South Touchet River remains in a highly dynamic, unstable state, individual reaches are beginning to express the attributes of a system moving towards equilibrium. For example, several reaches have naturally developed greater channel length, sinuosity, and associated decreased gradient which has resulted in development of single thread channel reaches with gravel bar formation, sediment storage, and colonization by hydrophytic vegetation.

Several of these reaches have also recently been colonized by beaver that are constructing off-channel dams and backwater areas which has elevated surface and groundwater elevations and provided floodplain access for floodflows. Emergent vegetation response includes establishment of hydrophytic shrubs and trees as well as herbaceous communities such as rushes and sedges.

Table 36 Mink Futures Analysis Based on DFC's (time=10 years)

Habitat Area & Variables	**Riparian/Forest Shrub < 405 ha**
Area (acres)	596
V1: Percent of year with surface water present.	1.0
V2: Percent tree canopy cover.	0.8
V3: Percent shrub canopy cover.	0.8
V4: Percent canopy cover of emergent vegetation.	0.2
V5: Percent canopy cover trees/shrubs <= 100m waters edge.	0.8
V6: Percent shoreline cover <= 1m of water's edge	0.8
Water SI = V1	1.0
Cover SI = (Min (1.0: V2+V3+V4)+V5))/2	0.90
H.S.I = Lowest life requisite value (lower of water SI or cover SI).	0.90
Estimated Number of Habitat Units at t=10 years.	**536.4**
Existing Habitat Units	**447**
Change in Habitat Units for time=10 years	**+89.4**
Annual Change in Habitat Units (89.5 /10)	**.894**
10-Year Change in Habitat Units	**+89.4**
Number Habitat Units in 10 Years	**536.4**

Enhancement Strategies - Increases in deciduous and hydrophytic shrub cover will be achieved through acquisition of grazing leases and rest (livestock exclusion), large wood additions to floodplains, and obliterating floodplain roadbeds and planting deciduous and hydrophytic shrubs. Rest of the grazing units will reduce browse pressure and allow shrub canopy cover to increase.

Large wood additions to fish bearing streams within the wildlife area (South Touchet, Griffin Fork and unnamed tributaries, and the Dry Touchet) are planned to address limiting factors for riparian dependent wildlife and resident and anadromous fish resources. Restoration and enhancement efforts will be designed and implemented to address stream channel dimension, pattern, and profile and facilitate reconnection of the floodplain. A variety of treatment strategies may be employed ranging from creating additional channel length through channel meander construction to taking a passive approach in individual stream reaches to allow natural recovery processes to facilitate stability and desired conditions. Related floodplain treatments include obliterating and decommissioning floodplain roads, improving road drainage and/or constructing appropriate cross drains, and planting/seeding to facilitate vegetation establishment. Overall DFC's related to improving trends in watershed hydrology and associated fish and wildlife habitat include increasing sediment storage within the floodplain, increasing channel sinuosity, reducing stream gradients, creating instream and floodplain complexity, and facilitating stability. This in turn will facilitate the establishment and development of riparian vegetation, including deciduous and hydrophytic shrubs that fulfill many of the life requisites for riparian dependent wildlife.

Grassland Cover Type Structural Characteristics

Grassland surveys were completed June 21-July 1, 1999. Surveys in grassland cover types were conducted prior to senesance of forbs and grasses. Twenty transects covering over 20,000 linear feet were completed with 234 square-meter plots and 19 one-tenth acres plots to characterize the cover type.

Table 37 Grassland Cover Type Structural Characteristics

Transect	% Cover Herbaceous	% Cover Grass	Mean Height Herbaceous (in)	Perch Distance (ft)	% Shrub Canopy Cover
1	34.73	29.27	7.15	8.09	0.62
2	27.96	17.32	10.15	16.64	0.32
3	28.03	23.75	11.26	5.69	0.15
4	16.36	14.24	14.40	5.19	0.15
5	35.10	21.60	9.76	5.85	2.6
6	22.62	10.83	13.20	11.79	0.21
7	36.29	32.90	12.26	4.18	0.07
8	21.09	18.67	11.58	14.49	0.46
9	27.86	12.61	8.41	8.35	1.9
10	24.20	16.55	9.02	4.28	0.70
11	23.17	17.10	12.44	2.85	2.9
12	46.11	26.50	11.90	8.34	0.33
13	26.73	20.50	12.31	1.36	0.36
14	13.85	11.50	10.65	6.09	0.24
15	37.25	26.50	9.65	3.92	0.25
16	33.59	24.17	14.70	1.18	0.17
17	33.40	24.10	12.09	1.78	0.30
18	29.41	17.27	10.34	12.19	0.45
19	29.96	21.71	12.40	3.76	0.21
20	16.86	12.09	10.02	5.29	0.27
Mean	**28.23**	**19.96**	**11.18**	**6.57**	**0.65**

Western Meadowlark

Baseline Habitat Suitability and Habitat Units – The western meadowlark model evaluates herbaceous cover and height, grass cover, availability of perch sites, and occurrence of shrubs within grassland plant communities. Variables in the model focus on the structural characteristics of grasslands associated with nesting, brooding, and foraging habitat. Grassland cover types within the wildlife area are generally in poor ecologic condition due to lack of perennial bunchgrasses and predominance of non-native annual grasses and noxious weeds. The following table presents the baseline assessment.

Table 38 Western Meadowlark Baseline Habitat Suitability Indices and Habitat Units

Habitat Area & Variables	Grassland
Area (acres)	1423.06
V1: Percent cover herbaceous plants.	0.18
V2: Percent canopy cover grass.	0.10
V3: Average height herbaceous canopy cover.	1.0
V4: Distance to perch.	1.0
V5: Percent shrub canopy cover.	1.0
H.S.I. $= (V1xV2xV3xV4)^{1/2}xV5$	**0.13**
Number of Habitat Units	**191.9**

Habitat Limiting Factors - Primary habitat suitability limiting factors include V1 (percent cover of herbaceous plants) and V2 (percent cover of herbaceous grasses). Poor cover conditions limit the suitability of the cover type to provide nesting, foraging, and brooding habitat. In terms of ecological status, the majority (over 90%) of the grasslands in the study area are classified in an early and very early sere with a very low percentage of perennial bunchgrasses (5%) and forbs (2.5%). Field surveys also documented grassland dominance by annual vegetation (20.6%) with 15% coverage of noxious weeds (yellow starthistle (Centaurea solstitialis, 4%), ventenata (Ventenata dubia, 8.5%), tarweed (Madia gracilis, 1%), and medusahead wildrye (Taeniatherum caput-medusae, 5%). These invader species are native to the Mediterranean but have thrived in the Subbasin due to similarities in climate between the two locations (Quigley and Arbelbide 1997a). All 19 grassland transects sampled in the study area contained exotic grasses and forbs.

Noxious weed issues are widespread in the Touchet River basin. Recent surveys conducted by the Columbia County Weed Board in the watershed found that 85% of upland range habitat was infested with yellow starthistle. Invasive species displace native plant communities, reduce plant diversity, and can accelerate soil erosion and surface runoff. Yellow starthistle forms solid stands that drastically reduce forage production for wildlife. Spotted knapweed, also obersved in the wildlife area, have been shown to decrease bluebunch wheatgrass by 88% (Columbia County Weed Board, 2000). Elk use was reduced by 98% on range dominated with spotted knapweed compared to bluebunch dominated sites (Columbia County Weed Board, 2000). Some of the most heavily infested noxious weed sites in the study area are located adjacent to the road network developed on the property during the last decade. In addition, seeding practices of the past have introduced a wide variety of non-native grasses and forbs. When native vegetation is replaced by aliens or when the potential dominant plants decline to a point where the cause of the change is so severe as to eliminate any opportunity for resurgence to former dominance – a threshold has been reached and passed (Johnson, 2001). In the example of bunchgrasses, annual forbs or annual grasses may eliminate the opportunity for perennial bunchgrasses to regain dominance of the site. This has occurred over large expanses of the ridgetops, canyon bottom along the South Fork Touchet River and on steep slopes of the study area. In our classification of seral stages, when the perennial potential bunchgrasses cease to occur at 5% or greater coverage, the site can no longer sustain those bunchgrasses unless managers intervene with cultural practices to restore the grassland (Johnson, 2001).

Desired Future Conditions - The primary DFC for the grassland cover type is to increase the percentage of both the total herbaceous canopy cover and the coverage of perennial native bunchgrasses. In conjunction with increasing native herbaceous species, noxious weeds as well as non-native annual grasses will decrease over time as the more persistent perennial bunchgrasses begin to re-colonize the grassland communities. The grassland cover type will possess between 15 – 25% native perennial bunchgrass cover in approximately 100 years. Increasers and invaders (especially forbs) will be co-dominant at will occur at 25-50% cover. Annual, exotic grasses and forbs will comprise less than 50% of the vegetative cover. The DFC is based on review of literature that points out that native Blue Mountain perennial bunchgrass associations that occur in less disturbed/more intact states, typically exhibit much higher cover values for perennial bunchgrasses and forbs and a conservative estimate our ability to restore native grassland communities. The following tables illustrate observed values.

Table 39 Cover Values Observed in Blue Mountain Bluebunch Wheatgrass/Sandberg's bluegrass Plant Association n= 29 (Johnson and Clausnitzer, 1992)

Species	Mean Cover (%)	Constancy (%)	Range of Cover (%)
Grasses			
Bluebunch Wheatgrass	29	100	2–65
Sandberg's Bluegrass	10	96	1–30
Idaho Fescue	3	31	1–7
Prairie Junegrass	6	31	1-20
Forbs			
Yarrow	3	79	1–10
Creamy Buckwheat	4	55	1–15
Biscuit root	2	59	1-7

Table 40 Cover Values Observed in Blue Mountain Idaho Fescue/Bluebunch wheatgrass Plant Association, n= 29 (Johnson and Clausnitzer, 1992)

Species	Mean Cover (%)	Constancy (%)	Range of Cover (%)
Grasses			
Idaho Fescue	23	100	3-75
Bluebunch Wheatgrass	17	89	1-30
Sandberg's Bluegrass	12	82	1-30
Prairie Jungegrass	5	42	1–15
Annual Bromes	9	18	1-20
Forbs			
Yarrow	3	89	1–10
Creamy Buckwheat	8	53	1–20
Phlox	5	35	1–16
Biquitroots	3	50	1–7
Hawksbeards	1	32	1-3
Arrowleaf Balsamroot	1	21	1-2
Serrated Balsamroot	4	28	1-10
Pale Agoseris	2	25	1-4
Lupines	5	43	1-25
Fleabanes	1	43	1-3

In addition to reviewing literature on plant community composition, we also referenced literature regarding studies that evaluated plant community succession, relative abundance of individual successional stages over time, and their distribution within a given landscape. These types of analyses are commonly termed an "Historic Range of Variability Analysis" or HRV and can be used to developed DFC's and guide management efforts. The following table illustrates approximate landscape acreage (in percentages) of grassland seral states that may have been present prior to the 1800s. It is based on topographic setting – not vegetation groups per se. A predictable pattern involves the role of natural fire and native grazing animals to maintain the majority of a given landscape in mid seral stages of successional development. Another pattern is that gentle or flat topography (slope = 15% or less) tends to be where early and very early seral vegetation is most prominent. Steep canyon slopes and ridge tops (removed from water) tend to support the highest percentages of late seral vegetation. Recognizing that less than 10% of the grasslands in the baseline condition are in mid to late seres, a reasonable objective or DFC would be to increase the occurrence of mid seres to 20% by the year 2100 (Johnson, 2001).

Table 41 Proposed Historic Ranges of Variability* (Johnson, 2001)

Seral State	Ridgetops %	U.Slopes %	Benches %	L.Slopes %	Bottoms %
Late Seral	25-35(30)	30-40(35)	15-25(20)	25-35(30)	5-25(15)
Mid Seral	35-55(45)	40-60(50)	50-60(55)	40-60(50)	50-60(55)
Early Seral	10-30(20)	5-15(10)	20-30(25)	5-15(10)	10-30(20)
V.Early Seral	5-15(10)	3-7(5)	5-15(10)	5-15(10)	5-15(10)

*Figures are in percent with the HRV given first with the mean value shown in parentheses.

Seral stages for grasslands are defined as follows. Decreasers are primarily bluebunch wheatgrass and Sandberg's bluegrass.

Early Seral - Climax bunchgrasses are subordinate to increasers, absent, or so few as to make natural re-colonization unlikely (especially forbs); increasers and invaders usually dominate the community (bunchgrasses – 0-15% cover, increasers and invaders – greater than 50% cover).

Mid Seral - Climax bunchgrasses are present; increasers (especially forbs) are co-dominant or dominant (bunchgrasses – greater than 15% cover but less than 25% cover. Increasers and invaders – greater than 25% cover but less than 50% cover).

Late Seral - Climax bunchgrasses are dominant; invading and increasing species are subordinate (bunchgrasses – greater than 25% cover, increasers and invaders – less than 25% cover).

The estimated habitat units produced by achieving the DFC are displayed in the following table. The estimated increase in habitat units is based on an increase in average perennial grass cover from 5% to 15%, an increase in total herbaceous cover from 28.23% to 40%, and an increase in percent cover composed of grass from 19.96% to 30% on enhanced grasslands. Note that >70% herbaceous canopy cover in the grassland cover type is considered optimum in the meadowlark model.

Table 41 Western Meadowlark Futures Analysis Based on DFC(t = 100 years)

Habitat Area & Variables	Grassland
Area (acres)	1423.06
V1: Percent cover herbaceous plants.	0.35
V2: Percent canopy cover grass.	0.20
V3: Average height herbaceous canopy cover.	1.0
V4: Distance to perch.	1.0
V5: Percent shrub canopy cover.	1.0
HSI = (V1xV2xV3xV4)1/4xV5	0.26
Number of Predicted Habitat Units	376.5
Existing Habitat Units	191.9
Change in Habitat Units for t=100 years	**+376.5**
Annual Change in Habitat Units (376.5/100)	**+3.77**
10-Year Change in Habitat Units	**+37.65**
Number Habitat Units in 10 Years	**229.55**

Enhancement Strategies – As described in the habitat limiting factors section above, the grassland cover type within the wildlife area contains a critically low composition of native perennial bunchgrasses. Once perennial bunchgrass cover drops below 20% in Idaho fescue and bluebunch wheatgrass plant associations, management intervention is the only method of changing plant community composition and initiating an upward successional trend. In order to begin to move the grassland cover type towards the DFC, a combination of both passive and active habitat enhancement and restoration techniques, coupled with decades of persistent management, will be necessary to restore healthy grasslands within the wildlife area. The road back toward a greater mix of seral stages and an increase in middle and late seres, will take many decades. It will only happen through adherence to a long-term plan that goes beyond lives of resource managers (Johnson, 2001). Although ecological conditions are generally poor, there are areas containing relatively intact, native bunchgrass communities that can serve as anchor or nucleous areas from which to focus restoration efforts. Habitat enhancement and restoration should be emphasized in areas of the landscape where the fastest improvements can occur (deep soils, stable, low ungulate impact) and seek to eliminate or minimize degrading disturbances. Restoration should focus on areas with the highest cover of desired perennials where the highest chance of success is afforded. Although lupine or balsamroot may dominate at undesired levels for a decade or two, their presence will help maintain microsite conditions including moisture and insulation which can promote germinating perennial bunchgrass.

Passive techniques include exclusion from unregulated livestock utilization and prevention strategies associated with limiting the spread of noxious weed and competing and unwanted vegetation (e.g., access and travel management restrictions). Active techniques include a combination of site preparation (herbicidal treatments, prescribed burning, use of livestock as a management tool) and seeding/planting. Range rest from livestock grazing and grazing annual grasses during late spring/early summer can help provide a competitive advantage for bunchgrasses where the grazing subsides prior to bunchgrass seed set and seedhead elongation. Prescribed burning may also be a tool to stimulate bunchgrass seedhead formation and reduce annual litter – thereby providing bare soil for seed germination.

Priority grassland treatment areas have been identified on the Dry Touchet Ridge located between Robinette Mountain and the South Fork Touchet River. Approximately 300 acres have been prioritized for ongoing weed control, prescribed burning, and seeding. Initial treatment activities have included herbicide application along native surface roads and skidtrails along the Dry Touchet Ridge to treat yellow starthistle and medusa head. Response has been good with additional planned treatments of prescribed burning and seeding/planting. Additional detail is provided in the management plan.

Baseline and Futures Analysis Summary

U.S. Fish and Wildlife Service (USFWS) Habitat Evaluation Procedures (HEP) were used to determine the number of habitat units credited to the Bonneville Power Administration (BPA) for land acquisition and habitat enhancements on the Rainwater Wildlife Area. The project is designed to partially mitigate habitat losses incurred by BPA for the construction of the Federal hydroelectric power projects at the John Day and McNary facilities on the Columbia River. Upland and riparian forest, upland and riparian shrub, and grassland cover types were included in the evaluation. Target wildlife mitigation species included downy woodpecker, black-capped chickadee, blue grouse, great blue heron, yellow warbler, mink, and Western meadowlark.

Habitat surveys were conducted in 1998 and 1999 in accordance with published HEP protocols and included 65,300, 594 678 m^2 plots, and 37 one-tenth-acre plots. Between 153.3 and 7,187.46 acres were evaluated for each target wildlife mitigation species. Habitat suitability indices derived for each species model were multiplied by corresponding cover-type acreages to determine the number of habitat units for each species.

Table 42 Baseline and Futures Analysis Summary

Evaluation Species	Evaluation Acres	Time to DFC (Years)	Existing Habitat Units	Habitat Units At Year=10
Downy Woodpecker	7,187.46	40	1,100.3	1,723.7
Black-Capped Chickadee	7,187.46	40	3,163.5	4,168.7
Blue Grouse	284.9	40	136.8	143.9
Great Blue Heron	596	40	119.2	119.2
Yellow Warbler	153.3	10	27.6	113.8
Mink	596	10	447	536.4
Western Meadowlark	1,423.06	100	191.9	229.6
Total			5,185.3	**7035.3**

Baseline habitat units total 5,185.3. Implementation of habitat enhancement and restoration activities could generate an additional 1,850 habitat units in 10 years. Baseline and estimated future habitat units total 7,035.3 for the Rainwater Wildlife Area.

Longer-term benefits of protection and enhancement activities include increases in native species diversity and plant community resiliency in all cover types. Watershed conditions, including floodplain/riparian, and instream habitat quality should improve as well providing multiple benefits for terrestrial and aquatic resources. While such benefits are not necessarily recognized by HEP models and reflected in the number of habitat units generated, they are consistent with the NPPC Fish and Wildlife Program. Development and implementation habitat enhancement and restoration strategies, coupled with protection and administration of the wildlife area will require long-term commitments from managers to increase probabilities of success and meet the goals and objectives of the Northwest Power Planning Council's Fish and Wildlife Mitigation Program.

CONSISTENCY WITH THE NPPC FISH AND WILDLIFE PROGRAM

Additional analysis was conducted to insure consistency with the scientific principles developed by the Northwest Power Planning Council and incorporated into the Council's Program in 2000. Plant community conditions in the study area were compared to data collected from USDA Forest Service-maintained, permanent reference plots in the Blue Mountains. Plots and reference plots were characterized using the plant association concept, and data from reference plots was used as aid in characterizing the ecological condition of plant associations in the Iskuulpa Watershed. The approach used in this HEP analysis is consistent with the following NPPC Principles (NPPC Program, 2000):

Principle 1. The abundance, productivity and diversity of organisms are integrally linked to the characteristics of their ecosystems.
The physical and biological components of ecosystems together produce the diversity, abundance and productivity of plant and animal species, including humans. The combination of suitable habitats and necessary ecological functions forms the ecosystem structure and conditions needed to provide the desired abundance and productivity of specific species.

In this analysis and associated report, we have characterize physical (climate, precipitation, soils) and biological (plant associations) components of habitats evaluated for mitigation wildlife species. The purpose of this effort was to; 1) identify how ecological functions and human activities have influenced present habitat suitability, and 2) determine appropriate habitat suitability indices (desired future conditions) within the context of site potentials of habitats within the project area.

Principle 2. Ecosystems are dynamic, resilient and develop over time.
Although ecosystems have definable structures and characteristics, their behavior is highly dynamic, changing in response to internal and external factors. The system we see today is the product of its biological, human and geological legacy. Natural disturbance and change are normal ecological processes and are essential to the structure and maintenance of habitats.

Inherent in the plant association concept is the recognition that plant communities move through seral stages over time depending on the frequency and intensity of disturbance. For example, in the Douglas fir/ninebark association, Johnson and Clausnitzer (1994) describe the role and effect of fire on overstory Douglas fir stands and the composition of the understory:

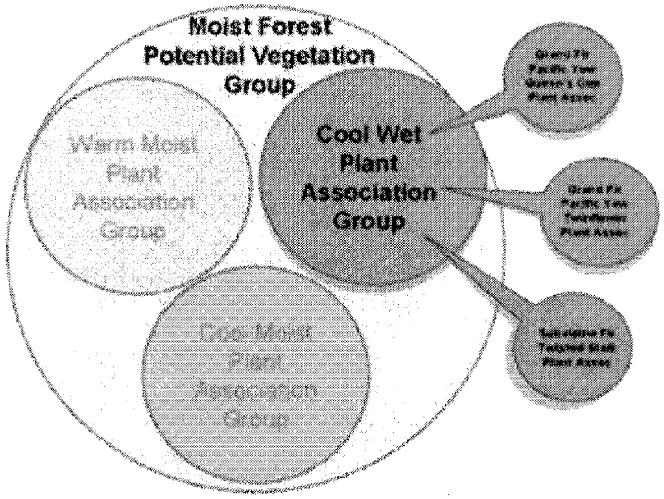
> Successional Relationships: *Stand replacing fir has been principal modifying event. Stands are replaced with shrubfields dominated by ninebark, oceanspray, Scouler willow, Rocky Mountain maple, cherry, and serviceberry. The pinegrass-elk sedge stand may also be promoted by tree-replacement burns. Forbs exhibiting an increase with fire...are fireweed, peavines, vetch, heartleaf arnica, and asters... Fire will promote shrubfields with a grass-sedge mosaic. These plants are rhizomatous and competition is intense. Very difficult to regenerate trees in less than 10 years. These early successional communities provide valuable browse for deer and elk. Older stands provide hiding or thermal cover. A relatively droughty forest; mistletoes and root rots are common.*

Consistent with Principle 2, we have quantified, where possible, human activities that have influenced the structure, composition, and diversity of habitats within the study area. In effect, identifying habitat conditions that are a product of human influences as well as other biologic or geologic factors.

Principle 3. Biological systems operate on various spatial and time scales that can be organized hierarchically.
Ecosystems, landscapes, communities and populations are usefully described as hierarchies of nested components distinguished by their appropriate spatial and time scales. Higher-level ecological patterns and processes constrain, and in turn reflect, localized patterns and processes. There is no single, intrinsically correct description of an ecosystem, only one that is useful to management or scientific research. The hierarchy should clarify the higher-level constraints as well as the localized mechanisms behind the problem.

Powell (1998) described the organization of "Plant Associations" into "Plant Association Groups" that represent ecological environments (temperature and moisture gradients such as "cool/wet" or "warm/moist"), which are in turn grouped into "Potential Vegetation Groups," defined as vegetation types having similar environmental conditions and dominated by similar types of plants (for example "moist/forest" or "dry/shrubland"). An example of this organization is again presented in Figure 6 with selected plant association groups of the moist forest potential vegetation group.

Figure 9 Organization of Plant Associations within the Moist Forest Potential Vegetation Group



The scale at which plant associations occur is determined by temperature-moisture gradients (spatial) and the role of disturbance regimes in plant succession (temporal). Disturbance regimes include characteristics of spatial distribution of disturbance, frequency (the number of disturbances that occur within a given time interval, or the probability of a disturbance occurring); return interval (mean time between disturbances); rotation period (how long it would be until an area equivalent to the size of the study area was disturbed); size; and the magnitude of force of the disturbance.

The plant association concept, when used to describe ecosystems, is useful to management because it segments the temperature-moisture gradient through indicative plant species and provides easier recognition of similar environments across the landscape (Johnson and Clausnitzer 1992). As a combination of similar or compensating environmental factors is repeated across the landscape, such as elevation, slope position, and aspect, a predictable plant community will occupy those sites given time and varying frequencies of disturbance (Johnson and Clausnitzer 1992). This community will then have similar physiognomy (form and structure) and floristics; and may also be called a climax community (Allaby 1994). It is believed that 1) the individual species in the association are, to some extent, adapted to each other; 2) the association is made up of species that have similar habitat requirements; and 3) the association has some degree of integration (Kimmins, 1997). Because environmental conditions vary continuously across the landscape, the resulting plant composition also varies. A plant association is therefore not an exact assemblage of species from one location to another. However, sites in the same plant association differ less than sites from different associations (Powell, 1998).

The hierarchy clarifies constraints on habitat suitability by characterizing the site potential of habitats based on their location along the temperature/moisture gradient and their current successional status as determined by disturbance events, or a lack thereof. For example, the ponderosa pine/bluebunch wheatgrass association, located in the "Hot, Dry Plant Association Group" within the "Dry Forest Potential Vegetation Group" would not be expected to produce as much basal area or canopy cover as a Grand Fir/Pacific Yew/Queen's Cup Beadlily plant association in the "Cool Wet Plant Association Group" of the

"Moist Forest Potential Vegetation Group." Because moisture is more limited on the ponderosa pine/bluebunch wheatgrass site, the site potential for basal area, and consequently canopy cover, decreases. Conversely, the open canopy nature of the "Ponderosa Pine/Bluebunch Wheatgrass" association allows greater light availability to the understory, and therefore the site potential for herbaceous cover is higher than in the Grand Fir/Pacific Yew/Queen's Cup Beadlily plant association .

Finally, application of the concept is useful to management because current HEP Models are only intended to relate life history requisites of selected species to habitat structure, they do not relate habitat structure to contextualized bio-physical environments and human influences.

> ***Principle 4. Habitats develop, and are maintained, by physical and biological processes.***
> *Habitats are created, altered and maintained by processes that operate over a range of scales. Locally observed conditions often reflect more expansive or non-local processes and influences, including human actions. The presence of essential habitat features created by these processes determines the abundance, productivity and diversity of species and communities. Habitat restoration actions are most effective when undertaken with an understanding and appreciation of the underlying habitat-forming processes.*

This principle has been addressed in this report by characterizing the bio-physical environment and addressing human influences on current habitat conditions in forested, riparian shrub, and grassland habitats. Changes in structure and species diversity for these habitats were in part linked to historical timber harvest, livestock grazing, and contemporary grazing schemes.

> ***Principle 5. Species play key roles in developing and maintaining ecological conditions.***
> *Each species has one or more ecological functions that may be key to the development and maintenance of ecological conditions. Species, in effect, have a distinct job or occupation that is essential to the structure, sustainability and productivity of the ecosystem over time. The existence, productivity and abundance of specific species depend on these functions. In turn, loss of species and their functions lessens the ability of the ecosystem to withstand disturbance and change.*

> ***Principle 7. Ecological management is adaptive and experimental.***
> *The dynamic nature, diversity, and complexity of ecological systems routinely disable attempts to command and control the environment. Adaptive management — the use of management experiments to investigate biological problems and to test the efficacy of management programs — provides a model for experimental management of ecosystems. Experimental management does not mean passive "learning by doing," but rather a directed program aimed at understanding key ecosystem dynamics and the impacts of human actions using scientific experimentation and inquiry.*

In this study we have utilized the plant association concept to investigate the biological problems of 1)determining normative ranges of habitat suitabilities, 2) identifying additive factors beyond site potential that are currently limiting suitability, and 3) developing sustainable habitat objectives (indices) within the constraints of the normative site potential. In doing so, we have improved the effectiveness of using HEP analysis as a means of developing objectives for habitat suitability.

Permanent plots provide the means for repeating ecological reconnaissance monitoring and understanding ecosystem dynamics (i.e. succession), the influence of normative processes, and the impacts of human actions such as timber harvest and livestock grazing.

Additional work is recommended to provide better supported futures analysis. Beyond prescribed management activities, it would be beneficial if futures analyses included the ability to model: 1) changes in plant community structure following stochastic disturbances, and 2) residence times in subsequent stages of seral development. Plans based on the assumption that natural disturbances will not occur yield projected future conditions that are of little relevance (Werner, et al, 1999). Evolving tools available for evaluating the potential effects of stochastic events on vegetation composition include the Vegetation Dynamics Development Tool (VDDT) and the Tool for Exploratory Landscape Scenario Analyses (TELSA).

The first version of the VDDT was developed for the Interior Columbia Basin Ecosystem Mangement Project to define pathway diagrams for forest and rangeland vegetation complexes. It has since been refined and applied to a wide range of vegetation types (Werner, et al, 1999). The VDDT examines the impact of landscape-scale disturbances while evaluating alternative management treatment alternatives. It simulates changes in the vegetative composition and structure resulting from both management activities and natural disturbances. Vegetation is classified into discrete states and pathway diagrams portray progression between states in the absence of disturbance. Disturbance probabilities for factors such as wildfires, windthrow, and management treatments are defined and also cause transitions between states (Werner, et al, 1999). The landscape nature of the model may make it appropriate for watershed-based projects such as Iskuulpa.

The TELSA is a spatially-explicit model of vegetative succession, natural disturbances, and management activities. It is designed as a planning tool for areas of 10,000 ha (24,710 acres) or larger, and uses VDDT model data plus spatial map data as input. All input and output are managed in relational data bases, and GIS-based tools are incorporated to enable spatial analysis of landscape characteristics (Werner, et al, 1999).

The VDDT and TELSA are not optimization tools. Instead, they assess the consequences of the interaction between management plans and assumptions about succession and natural disturbances.

Other available models of vegetative change for landscapes include the LANDscape SUcession Model (LANDSUM), which was developed as a research tool to investigate landscape fire succession modeling, but can be used as a management tool. LANDSUM models succession, harvest, disease, and fire; the classification system used is structural stages and cover types within potential vegetation types (Barret, T.M., 2001).

The SIMPPLLE is taken from **SIM**ulating vegetative **P**atterns and **P**rocesses at *L*andscape Sca***LES***. It was designed as a management tool to understand how processes and vegetation interact to affect landscape change. Processes modeled include succession, harvest, disease, insects and fire. The classification system is based on current species, potential vegetation, density, and structure. SIMPPLLE is stochastic and spatial based, and outputs include maps and charts of processes.

Principle 8. Ecosystem function, habitat structure and biological performance are affected by human actions.
As humans, we often view ourselves as separate and distinct from the natural world. However, we are integral parts of ecosystems. Our actions have a pervasive impact on the structure and function of ecosystems, while at the same time, our health and well being are tied to these conditions. These actions must be managed in ways that protect and restore ecosystem structures and conditions necessary for the survival and recovery of fish and wildlife in the basin. Success depends on the extent to which we choose to control our impacts so as to balance the various services potentially provided by the Columbia River Basin.

This Habitat Evaluations Procedures report has attempted to document, where possible, the manner and magnitude in which human actions have affected the habitat structure and therefore biological and ecological functions in the Iskuulpa Watershed. Primary anthropological factors limiting ecosystem function, habitat structure, and biological performance are related to the direct, indirect, and cumulative effects of past livestock grazing, road construction, and timber harvest, which have simplified the structure, composition, and diversity of native plant communities.

Finally, use of the plant association concept to evaluate existing conditions and develop desired future conditions is also consistent with NPPC Habitat Strategies, which include the following:

"Use Native Species Wherever Feasible

Even in degraded or altered environments, native species in native habitats provide the best starting point and direction for needed biological conditions in most cases.

Restore Ecosystems, Not Just Single Species
Increasing the abundance of single populations may not, by itself, result in long-term recovery. Restoration efforts must focus on restoring habitats and developing ecosystem conditions and functions that will allow for expanding and maintaining a diversity within, and among, species in order to sustain a system of robust populations in the face of environmental variation."

Using plant association classifications and the corresponding data allows managers to not only compare the structural characteristics of study and reference sites, but also species richness and diversity.

Achieving consistency with the NPPC's Habitat Strategies implies that effective and responsible mitigation requires more than addressing habitat suitability for selected targets species, it also requires commensurate efforts to restore ecosystem diversity.

GLOSSARY

Age Classes: A grouping of trees according to age, usually in broad categories, used for growth projections.

Breeding Site: The immediate area and features associated with producing and rearing young (e.g. nest tree, den, lek, etc.).

Breeding Area: The area necessary to support reproduction and rearing of young; includes breeding sites and may include a disturbance b&fer.

Browse: That part of the current leaf and twig growth of shrubs, woody vines, and trees available for animal consumption.

Canopy Cover: The portion of ground, usually expressed as a percentage, that is occupied by the perpendicular projection down on to it of the aerial parts of the vegetation or the species under consideration. The additive cover of multiple strata or species may exceed 100%.

Cavity: A hollow excavated in trees usually by birds or other natural phenomena; used for roosting and nest sites by many mammals and birds.

Closed Tree Canopy: A class of vegetation that is dominated by trees with interlocking crowns (forming 60 - 100% crown cover).

Cover Type: An area of land or water with similar physical, chemical, and biological characteristics that meet a specified standard of homogeneity.

DBH: Diameter at breast height (4.5 feet).

Deciduous Cover: Vegetation classes where 75% or more of the vegetation is made up of tree or shrub species that shed foliage in response to an unfavorable season. There is usually one "leaf - off" season per year.

Diversity: The distribution and abundance of different plant and animal communities within a given area.

Erosion: Detachment and movement of soil or rock fragments by wind, water, ice, and gravity.

Evaluation Species: Species chosen to represent general habitat types and habitat requirements of wildlife using those habitats.

Evergreen Cover: Trees or shrubs which maintain leaves all year (conifers, sagebrush, etc.).

Floodplain:

Forage: The edible vegetation produced seasonally or annually in a given area that is consumed by wildlife and livestock.

Foraging Area: Feeding areas that are regularly used by individuals or groups of animals. Guild: A group of wildlife species that share common habitat requirements/ecological characteristics.

Habitat: The natural environment of a plant or animal.

Habitat Evaluation Procedure (HEP): Ecological based procedure that describes habitat by a set of measurable habitat variables important to the evaluation species. The value of an area to a given species is the product of.the size of the area times the quality of the area for that species or Habitat value = Habitat quantity x Habitat quality.

Habitat Suitability Index (HSI): The numerical value of habitat quality expressed in index form from 0 to 1 .O whereas 0 is the lowest habitat quality measurement and 1 .O is optimum habitat.

Habitat Units (HUs): The HSI x Area = HU, or one HU is equal to one acre of optimum habitat for a given species.

Herbaceous: A class of vegetation dominated by non-woody plants known as herbs (graminoids, forbs and ferns).

Herb: Non-woody vascular plants such as grasses, grass-like plants and forbs.

Hiding Cover:

Historic: Refers to that period of time for which written records exist.

Historic Range of Variability:

Hydrophyte: A plant which has evolved with adaptations to live in aquatic or very wet habitats, e.g. cattail, water lily, etc.

Intermittent Stream:

Life Requisite: Food, water, cover, reproductive, or special requirements of an evaluation species supplied by its habitat.

Mitigate: To alleviate or make less severe. When habitat damage is unavoidable or has already occurred, it is the action needed to reduce and/or compensate for losses to wildlife and habitat.

Mitigation: Recovering and sustaining lost habitat and species productivity as a result of the construction and operation of the federal and non-federal hydropower system.

Mitigation Credit: Number of HUs gained through land acquisitions, conservation easements, and habitat improvements on mitigation lands.

Monitoring: Periodic evaluation of mitigation lands to assess the effectiveness of mitigation measures. Initial collection of baseline data with routine monitoring of habitat quality and wildlife population trends every five years is proposed.

Noxious Weeds: Undesirable plant species.

Operation and Maintenance (O&M): Activities and expenditures required to maintain project lands/habitat in desired condition. This includes weed control, range and forest management, agricultural practices, etc.

Perennial Stream: A stream that flows year round.

Plant Community:

Seral Stage:

Shrubs: Woody plants that generally exhibit several erect, spreading, or prostrate stems; and have a bushy appearance.

Successional Stage:

Tree: Woody plants that generally have a single stem, grow larger than 16 feet tall and have more or less definite crowns.

Variables: Factors that describe habitat in terms of the needs of the evaluation species.

Vegetation Cover: Vegetation that covers or is visible at or above the land or water surface.

Vegetation Typing: Delineation of plant communities on aerial photographs.

Winter Range: Habitat used by wildlife species during the winter months to provide shelter and food.

Xeric: Habitat having a low or inadequate water supply i.e., dry areas.

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APPENDICES